PHOTOGRAPHY

ARTISTIC AND SCIENTIFIC

BY

ROBERT JOHNSON

AND

ARTHUR BRUNEL CHATWOOD

(*Associate of the Institute of Electrical Engineers*)

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INTRODUCTION.

THE strides that photography has made during the last few years, due to the patient and earnest work of a large body of experimentalists, have not been an unmixed blessing; the production of sensitive plates and other materials at cheap rates, and the possibility which exists to-day of buying everything ready prepared, have induced thousands to take up photography as an amusement, not as a "hobby." The result has been that the quality of the work produced has deteriorated. We do not say that photographs are not produced to-day far excelling those of the wet collodion period, but we do say that if the whole of the plates exposed in any recent year could be collected, the average quality of the results, whether from the technical or the artistic standpoint, would be found much lower than that of twenty years ago.

In the days of wet collodion, only those who were prepared to take great trouble, to exercise much thought, and to do serious work, were attracted by photography. The enormous amount of *impedimenta* that it was necessary to carry about deterred the half-

hearted; the trouble of preparing plates caused every effort to be put forth to make each plate serve a useful purpose, and the fact that negatives were developed on the spot, gave every opportunity for correcting by a second exposure the errors of a first.

"Some years ago," says a contemporary magazine, "when amateur photography was in its infancy here, as well as in other countries, a soulless corporation extensively advertised a camera which only required a button to be pressed and pictures were made. The idea soon took root that there was nothing in photography, when it merely required the pressing of a button. It was apparent that any fool could do that. And when these cameras were purchased and tried, the result convinced the owners of the fact, not only that any fool could do it, but he was a fool a good many sizes larger for doing it. A feeling of disgust and disappointment was created, and there is little doubt but that photography was taken up by thousands and dropped again when they found out how it had been misrepresented to them. I firmly believe that many of these, had they thoroughly understood what was required to become a successful photographer, would have taken the matter up properly with determination to master it thoroughly, and would eventually have succeeded."

This is true not only of America, but in a lesser degree of this country. The proportion of English amateurs who aspire to become "button pressers" is not large, but the proportion who commence to photograph with a clear idea of the study, care, and thought necessary to success is infinitesimal.

Photography is considered by very many as an art, and photographers, consequently, as artists; nothing

could be further from the truth. Photography is purely an interesting science; it records with greater or less fidelity the scenes and incidents presented to it; and this record is governed by scientific and mechanical principles alone.

Art consists of the representation of a conception formed in the mind of the artist in such a way as to be appreciable to other minds. And the photographer becomes an artist only in so far as his work shows that he has the mind of an artist.

The aim of the photographer should be to produce by means of his camera, and by the aid of greater or less technical skill, not merely exact and minute copies of the objects which he photographs, but photographs which shall be the expression of his feeling and taste, and as such shall be entitled to rank as works of art. We are well aware that very few photographers look on their work from this point of view; they claim the title of Artist, but are ignorant of even the elementary laws of art. An amateur of exceptional technical skill showed us not long ago a negative of which he was most proud; it had in it all the elements which might with a little taste have made a picture, but he expected us to admire it only on account of its technical perfection and sharpness. One might read an advertisement "Beecham's Pills" standing in the middle of a field some half mile distant.

The mistake into which this amateur had fallen is a common one, and one which is destructive of beauty. An author's first care is to express what is in his mind in the most beautiful language at his command; but language is never beautiful, it ceases in fact to be language if it is devoid of meaning and purpose. So a photograph such as the above can never be beautiful,

whatever the degree of technical skill which it evidences, unless it expresses some idea, and thus has meaning and purpose.

The amateur who undertakes the study of photography with a determination to succeed, will find that he has a difficult but not an impossible task. He will have two branches of study, each helpful in the pursuit of the other, the laws of artistic composition, and those governing the physical and chemical processes with which he has to deal.

In the present work, we have put before him the chief elementary laws and principles of each branch, and as we think that his early efforts to master the technical difficulties of photography should be used to aid the study of the artistic side, we have asked him to give some attention to the laws of composition before commencing practical work.

If this line be followed, there is no reason why each exposure should not serve the purpose of accustoming him to select his subjects with care and taste, as well as of an exercise in the technical branch of the subject.

The gravest difficulty which he will have to surmount, and the one in which he can least profit by outside help, will be the realization of the fact that he is producing a monochrome rendering of a coloured subject, the training of his mind to dissociate colour from his subjects and to see their monochrome value; but unless this difficulty be surmounted, he will often be deceived by the beauty of a view which will appear entirely uninteresting when rendered in monochrome, by a process which does not even give to each colour its true value.

Our object is to lay before the reader, in as concise and simple a manner as possible, the fundamental principles which must guide him in the selection of his

subjects and in their reproduction by means of his camera.

He will find that by the use of a little judgment in the choice of subjects, he will at the commencement of his studies be able to avoid those which present exceptional technical difficulties.

We are all more or less familiar with the beautiful scenery of Switzerland; many of us have attempted to reproduce it with our cameras, but our efforts have met with little success, as in what may be considered the typical Swiss scene we meet many and great difficulties. We look upon a broad blue lake surrounded by lofty mountains, which, starting from a base hidden by the yellow and green of the foliage, become rosy in the sunlight as the vegetation ceases; we see the naked rocks, their warm madders diminishing in intensity as our glance travels upwards till it reaches the crown of eternal snow gleaming in the sunlight and cutting sharply against the blue sky.

If such a subject be treated in the ordinary way the result is worthless, the foliage and darker portions of the rocks will come out as black patches without detail; the lake, the upper portions of the mountains, and the sky, will form two patches of white, the summit of the mountains being lost in the sky.

Although there is no reason, as we hope to show, why such subjects should not yield interesting photographs if care and thought are exercised in the exposure and development, we would advise that they should be avoided until considerable experience has been gained.

In pursuance of our object we have omitted from the text all formulæ which might in any way interfere with clearness, or tend to obscure the principles of each

process. We have also made very full use of the help afforded by illustrations, either selected from a very large number of negatives taken by ourselves, or kindly lent by friends, but in many cases photographed specially.

In Chapters XI. and XII. we have endeavoured to show how subjects presenting special photographic difficulties may best be treated, and have done our best to explain the principles governing the truth and falsity of photographic rendering of light and shade. We have not attempted to describe the countless modifications of the various processes which have been introduced during the last few years; since, when the chief types are well understood, these slight modifications present no difficulties. By adopting this course we have, we believe, been able to condense into one volume all the information absolutely requisite for the production of photographs which shall be interesting, not only from a technical, but from an artistic standpoint.

We take this opportunity of thanking, not only those who have assisted us by the loan of negatives and in other ways, but those to whose works we have been able to refer, and by whose patient research photography has been advanced.

CHAPTER I.

CHEMISTRY OF PHOTO PROCESSES.

ALTHOUGH the chemistry of photographic processes is a subject of great breadth and complexity, we shall discuss only those portions which deal directly with problems of every-day occurrence.

We have heard many clever photographers maintain that a knowledge of chemistry was of no practical use to the photographer. We must at once say, that whilst an operator unacquainted with the subject may produce good photos, he works unintelligently and in the dark, he does not understand the materials which he employs, and is perforce ignorant of their capabilities and the limits of their power. As soon as circumstances arise which his experience cannot deal with, he is like a ship without a rudder, he is helpless.

We hold that it is as important for the amateur who aspires to produce good work to understand thoroughly the chemical principles of the various processes which he employs, as it is for him to know how to focus or arrange his view.

We all know that if a sensitive plate be exposed in the camera, and afterwards immersed in certain solutions, a visible image is produced, and that if a similar plate is immersed in the same solutions without having been exposed to light, no image is formed; we must

conclude, therefore, that the image has in some way or other been impressed during the exposure in the camera. Further experiment shows that this image is only impressed when light reaches the plate through the lens, and that the blackness or opacity of its various parts bears some relation to the amount of light forming those parts.

In what way is this invisible image impressed upon the plate; what are the changes taking place in the composition of the plate; what are the changes taking place on the application of the developer which causes an invisible image to become visible? These and many similar questions form the problems which the photographic chemist is called upon to solve.

It is useless to maintain that a correct understanding of the principles by which these reactions are governed is useless; if it serve no other purpose, it offers a useful guide to the operator, and places him in many cases on the same level as another who has had ten times as much experience, and it further goes far towards teaching him what can and what cannot be done.

There are innumerable bodies sensitive to light, but those only with which we shall concern ourselves are the salts of silver, iron, and chromium, and certain of the fugitive dyes.

The chief silver salts are the bromide, iodide and chloride, which are invariably formed in photographic processes either by the mixture of a solution of silver nitrate and of a soluble bromide, iodide or chloride, or by the application of a solution of one of these salts to the other held in suspension in a gelatine, collodion, or other film. (We neglect the formation of the iodide in the daguerreotype process.) The action of light on

each is somewhat similar, we shall therefore speak of the bromide, although including the iodide and chloride in the [illegible].

There have been many theories put forward to explain the action of light on these compounds; but the explanation generally accepted is that the molecule of silver salt is comprised of two atoms of silver and two atoms of halogen; that under the action of light the compound is decomposed, parting with one of its halogen atoms, and becoming a sub-bromide.

There is strong proof of the truth of this theory in the fact that if silver bromide is submitted to the action of strong light, bromine can be smelt, and the fact that the sensitiveness to light is greatly increased when the salt is in contact with some body which readily combines with the bromine, is again a strong piece of evidence in favour of this explanation. In the case of the iodide this action is strongly marked; it is difficult to impress an image by the action of light on a film containing iodide alone unless some body capable of taking up the iodine be present.

Although the image formed in the camera is usually called the "latent" or "invisible" image, it is only invisible because the human eye is not delicate enough to appreciate it. That this is so is sufficiently proved by the fact that by allowing the light to act for a comparatively long period it becomes to a certain extent visible. This image is composed of a minute quantity only of the sub-bromide, and the possibility of practical development depends on the fact that during development aggregation takes place.

There are many methods of development possible, but in the case of silver salts the only one worthy of

practical attention is that of the reduction of the sub bromide to the state of metallic silver.

Considering the action of the ferrous oxalate developer, as being the simplest, we find that when it is applied to a sensitive plate which has previously been exposed in the camera, the sub-bromide formed by the action of light is reduced to metallic silver. This silver being in so fine a state of subdivision cannot exist in the presence of silver bromide; a molecule of silver and one of silver bromide therefore combine to form two molecules of silver subbromide, these again being reduced and combining with other molecules of bromide, and so on until the image is sufficiently built up.

In the process of development the ferrous salt is oxidized to form a ferric salt, and ferrous bromide is formed thus:—

$$2\,Ag_2Br + 3\,Fe\,C_2O_4 = 4\,Ag + Fe\,(C_2O_4)_3 + Fe\,Br_2.$$

Both the ferric oxalate and the ferrous bromide formed have a strong action in retarding development.

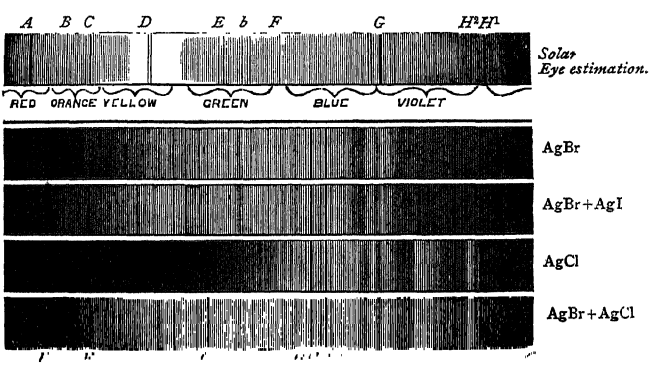
In this process it has been found that a small quantity of sodium hyposulphite hastens the action. The cause is, we think, twofold; the hyposulphite acts on the ferrous bromide, forming sodium bromide (a mild restrainer) and hyposulphite of iron; the hyposulphite also combines with the ferric oxalate to form ferrous oxalate and ferrous hyposulphite, together with sodium oxalate.

It will be seen that there is a tendency for the image to spread in development, on account of the aggregation spoken of; microscopic examination has proved the existence of this spreading, but it is not so great as to be a practical defect, except in a few special cases with which we are not at present concerned.

Having now glanced at the action of light on the sensitive compound, and at the reactions taking place in development, it will be well to consider the action of light more carefully.

When sunlight is decomposed by the action of one or more prisms into its component parts, we find that at one end of the spectrum formed the light is violet, at the other red, the change of colour taking place gradually, and passing from blue to green, yellow, orange, until the red is reached. The yellow portion of the spectrum is that which has the strongest effect on the eye; but a photograph of this spectrum on an ordinary plate shows that the yellow portion has only a slight action; the blue and violet rays are those which cause the greatest effect on the sensitive plate.

The exact portion of the spectrum possessing the greatest actinic or photographic effect varies according to the salt used. Many experimentalists are at the present time working with the object of extending this range of action.



Drawn on wood from photos.

We give the preceding photographs (taken specially

for this work by J. W. Gifford, Esq.), showing the action of the spectrum on the bromide, and chloride of silver, and on mixtures of these salts.

We shall have occasion to refer again to these photographs later, when speaking of isochromatic photography.

We shall now leave the subject of the action of light and the reactions taking place during development, although we should advise the amateur to carry his investigations much further; in doing so he will get much help from the works of Captain W. de W. Abney and others, as also from the photographic journals. We have not spoken of the principles involved in the choice of the material in which to suspend the sensitive salt, although this is of great importance; but we feared that the complexity of the subject would preclude its admission in an introductory work such as the present.

After the development is complete, a large quantity of the haloid salt is left unaltered. This must be removed, for two reasons: firstly, it is almost as opaque as the deposit of metallic silver, the negative would therefore not print; secondly, it would be acted upon by light, and destroy the negative.

This removal is called "fixing," and is accomplished practically by means of solutions of potassium cyanide or of sodium hyposulphite.

In the gelatine process, with which we are at present alone concerned, the hyposulphite is invariably used, since the cyanide tends to destroy the developed image by the solution of the deposited silver.

The reaction which takes place in fixing with sodium hyposulphite is represented as follows:—

$$2\,AgBr + 3\,Na_2S_2O_3 = Ag_2Na_43\,(S_2O_3) + 2\,NaBr.$$

If, however, a weak solution only be used, a different reaction occurs, and an insoluble form of hyposulphite is formed thus :—

$$Ag\,Br + Na_2S_2O_3 = Ag\,Na\,S_2O + Na\,Br.$$

It is, therefore, important that a strong fixing solution should be used.

Intensification may take place in various ways; either the colour of the deposit may be rendered less actinic, or the deposit may be increased by the deposit of silver or some other metal upon it, or a dark-coloured salt may replace the metallic silver. It is hardly, we think, necessary to enter into these reactions at present. Those occurring in toning prints are very similar.

Before leaving this branch of our subject, it is as well to point out that in handling or developing sensitive plates, such light only may be used as has no appreciable action on the salts employed. In using gelatine plates it is found that a ruby-coloured light fulfils this requirement, and this light is the one usually employed. It is obtained by means of a lamp with ruby glass chimney, or by glazing a portion of a window with ruby glass and darkening the remainder.

As far as we are at present concerned, the action of the iron salts does not interest us, except in so far as it concerns the platinotype process. The ferric salts are reduced by the action of light to the ferrous state, and this action is the basis of numerous printing processes which we do not propose to describe.

In the platinotype process the developed image consists of metallic platinum, although the sensitive salt employed is a ferric salt. the action being as follows :—

A platinum and a ferric salt are mixed and applied to

the paper. Under the action of light the ferric salt is reduced to the ferrous state whilst in contact with the platinum salt. The action of the developer is to dissolve the ferrous salt, the platinum salt being reduced to the metallic state by the ferrous salt *at the moment of solution*; the image left, therefore, is in pure metallic platinum. The action is stated by Berkely to be represented as follows:—

$$3\,K_2Pt\,Cl_4 + 6\,Fe\,(C_2O_4) = 3\,Pt + 2\,Fe_2\,(C_2O_4)_3 + 6\,K\,Cl + Fe\,Cl_6$$

A more simple process for obtaining prints in platinum has been invented by Captain Pizzighelli. Its chief characteristic is that the developer is added to the sensitizing solution applied to the paper, and development takes place simultaneously with printing, by the aid of atmospheric influences.

The importance of the sensitive chromium salts in photographic processes is confined, with one exception, to their utility in certain processes for printing in greasy inks by mechanical means. This exception, the carbon process, alone concerns us. This process depends on the fact that if gelatine or a similar colloid body be mixed with a sensitive chromium salt—usually potassium dichromate—and exposed to light, it becomes insoluble, whereas where light has not acted it remains soluble. The exact chemical action which takes place we are unable ourselves to state; it has been given by Mr. Swan as follows: "Gelatine, aided by light, reduces the chromic acid of the dichromate to a lower state of oxidation, and then enters into combination with a compound of chromic oxide produced by the mutual decomposition of the chromic acid and gelatine, being the formation of a leather-like substance."

Space has only allowed us to give a very brief outline

of those portions of this most interesting subject with which we are most frequently concerned, but we should certainly recommend its further study by those who aim at becoming thoroughly proficient operators. In this connection we would say, that experiments carefully made form the most secure basis on which such knowledge can rest, and that the result of even the most simple experiment is worthy of record, as it is frequently from some simple experiment that a new line of thought is started, which may, and often does, lead to valuable discoveries.

CHAPTER II.

APPARATUS—LENSES, CAMERAS AND TRIPODS.

ALTHOUGH it is quite possible to take photographs without any lens whatever, by the use of what is known as a "pinhole," the lens is yet the most important part of a photographer's apparatus.

The "pinhole" possesses all the qualifications sought for in an ideal lens except that of rapidity. It produces images that are absolutely rectilinear, that are equally sharp all over the plate, it has unlimited "depth of focus" (that is to say, that objects at varying distances from the camera are brought to a focus in one plane), it has no particular focus (that is to say, that the plate may be moved nearer to or farther from it without destroying the sharpness of the image, and so a greater or smaller angle of view may be included); but exposures require to be so prolonged that it has no practical value, and pinhole photographs are simply interesting curiosities.

Photographic lenses may be divided into three main classes, portrait, rectilinear, and landscape, according as some one or more qualities necessary to the particular purpose have been gained by the sacrifice of others, desirable, perhaps, in themselves, but less essential.

The object aimed at in portrait lenses has been

rapidity, since the dull light of the studio entails comparatively long exposures, which mean, in very many cases, the movement of the sitter. The rapidity of a lens depends almost entirely upon the ratio which its effective aperture bears to its focal length; the increase of this ratio has prevented the portrait lens being entirely corrected for spherical aberration. It also reduces the depth of focus; so that in some cases if the sitter's eye be focussed, the tip of the nose is visibly out of focus; this is an extreme case and denotes a poor lens. A portrait lens should be rectilinear, that is to say, that vertical and horizontal straight lines in the subject should produce vertical and horizontal straight lines on the ground-glass.

The rectilinear lens is an absolute necessity for architectural subjects, and for copying. It should produce a sharp image all over the plate with its full aperture, and this aperture should be as large as possible.

In landscape work pure and simple, a small amount of distortion is not noticeable, and is therefore of no consequence. With a landscape lens any straight lines in the subject, except those that cross the axis of the lens, are more or less curved, the distortion being known as "barrel" or "pincushion" distortion, according to whether the lines are curved away from or towards the centre of the plate. The same lens produces the one kind of distortion or the other, according to whether the concave or convex side of the lens is towards the subject.

The landscape lens consists of two lenses cemented together to form an achromatic combination. The rectilinear consists essentially of two landscape com-

binations with their concave surfaces towards one another, and more or less separated.

In examining a lens, the first thing is to determine its focus, or rather focal length, by fixing it in the camera and focussing some object on the ground-glass, and by moving the camera nearer or further from the object, making the image on the ground-glass the same size as the object. The distance between the object and the ground-glass will now be four times the focal length of the lens.

A better method, however, is to focus some object and measure the size of its image on the screen, then compare the size of this image with that produced by another lens of known focal length; the focal lengths will be proportional to the size of the images. A spectacle glass may be used in making this comparison, since its focal length can be determined by focussing a distant object and then measuring the distance between the centre of the lens and the ground-glass. The size of the circle which the lens will illuminate should be ascertained.

Definition, flatness of field, astigmatism and spherical aberration, may all be considered at the same time and must be tested in relation to the aperture. To carry out these tests a sheet of printed matter should be attached to a drawing-board and focussed in the camera. The lens should produce an image in which the letters are absolutely black without any trace of greyness or fuzziness, and the larger the diaphragm with which this can be done the less the spherical aberration and the greater the definition, also the flatter the field.

To prove whether astigmatism is present or not, focus the same object—with the full aperture of the lens—so

that the centre portion is absolutely sharp; the margin will be more or less fuzzy, on account of the curvature of the field; now rock the camera in and out, and if a point can be found at which the image at the margin is sharp, the lens is free from astigmatism.

In making these tests the straightness or curvature of the lines will prove whether the lens is rectilinear or not.

Most optical instruments are not required to bring the actinic and the visible rays to a focus at the same point, but in photographic lenses this is essential. The coincidence or otherwise of the actinic and visual foci may be demonstrated by arranging a series of numbered cards, say seven, one behind the other, focussing the middle one sharply, and exposing a plate, when if the two foci coincide the card which was focussed for will be the sharpest, and if the coincidence is not perfect a card nearer to or further from the lens than the middle one will be sharpest.

All photographic lenses possess in a greater or less degree a defect known as "flare spot," which is an image of the diaphragm formed by reflection and refraction; in a good lens this defect is spread over the whole plate by the adjustment of the position of the diaphragm, and is therefore not noticeable.

The less important defects of lenses are bad surface finish, colour, air-bubbles, and striæ or irregularities in the density of the glass. The glass of which lenses are made should be colourless, as any colour will interfere with the rapidly of the lens; this quality may be examined by looking through the lens at a piece of dead-white paper.

Surface finish may be examined by holding the lens near a gas jet turned low, and examining its surface by the aid of a watchmaker's glass.

Bubbles can, of course, be seen without difficulty and are of minor importance, since they act only as so many opaque spots, and thus reduce the amount of light that will pass through the lens: of course, if large or numerous the lens should be condemned.

Striæ form a more serious defect, since they interfere with the regular refraction of the rays of light, and deteriorate the definition. They may be detected by taking the lens into a darkened room, and examining each lens separately by turning it about one way and another near a gas jet turned very low; any inequality in the density of the glass is thus easily detected.

A knowledge of the principles underlying the use of stops is of paramount importance to the photographer. Too many amateurs seem to use their stops for the simple purpose of prolonging exposure, whereas they serve two far more important purposes. In a landscape objective a comparatively small stop is a necessity, since the correction for spherical aberration being imperfect, it is essential that the centre of the picture shall be formed by rays passing through the centre of the lens, and the margins by rays passing through the margins of the lens.

In the case of a portrait or rectilinear objective, their most important use is that of increasing depth of focus, that is to say, of causing objects nearer to and further from the camera than the object focussed for to appear sharp. We say to appear sharp, because an objective will only render objects in one plane mathematically sharp, all others are to a greater or less degree fuzzy. It is generally admitted that if any object is rendered with only a disc of confusion of $\frac{1}{100}$ of an inch it may be considered sharp, but, in our opinion, the amount of

fuzziness permissible varies considerably with the size of the photograph, and that the above estimate is correct for a photograph between a whole plate and a 15 × 12, less sharpness being requisite in large sizes, whereas the disc of confusion should not exceed $\frac{1}{200}$ in a quarter plate. The reason of this variation is simply that the larger the photo the greater the distance from which it is viewed.

The effect of the stop can be best shown by diagrams.

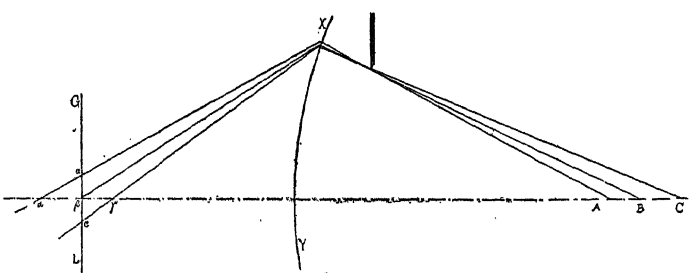


DIAGRAM 1.

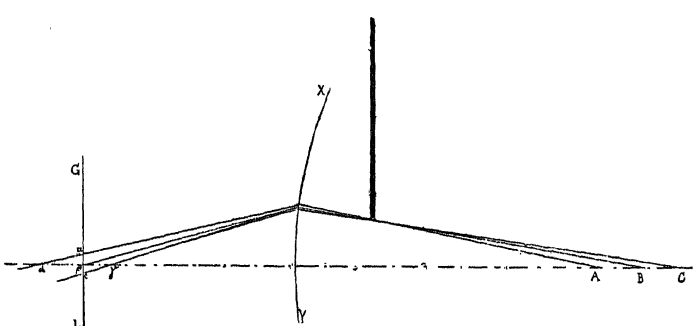


DIAGRAM 2.

A comparison of the two diagrams shows very clearly the reason for increase of depth of focus with reduction of aperture.

A B C represent the positions of three objects situated at different distances from the lens.

α β γ indicate the positions of the respective images of these objects.

GL represents the position of the ground-glass on which the image of B is received.

The rays proceeding from A and C cross the axis of the lens at α and γ respectively. The distances β c and β a show the amount of blurring or confusion.

In diagram 2 none of the conditions have been changed except that the diaphragm has been reduced, showing that the rays which pass through the margin of the lens to form the images cross the axis at a smaller angle; the distances βc and βa are therefore reduced, and the images of A and C appear, in consequence, more sharp.[1]

In choosing a lens, the focal length suitable to the size of plate to be used should be carefully considered, since a photograph is only true in perspective when looked at from a distance equal to the focal length of the lens with which it was taken; the distance from which a person with normal sight ordinarily views a photo, therefore, settles the focal length of the objective which it is desirable to employ. This distance will be found to be about one and a half times the length of the longest side. It is frequently impossible to use an objective of this focus, either because the distance from which the view must be taken is fixed by artistic requirements, by lack of space or by other considerations; in these cases an objective of as nearly the desirable focus as possible should be selected.

From the above it will be seen that it is desirable to

[1] See Appendix C.

have a series of objectives of different foci, and to use short focus objectives only when it is necessary to include a large angle of view.

The choice of a camera is more difficult than that of a lens since the differences between one variety and another are so slight, but the choice is also of less importance than in the case of lenses. Every camera should be provided with an arrangement for raising and lowering the lens, and care should be taken that the normal position of the lens is exactly central—that is to say, that when a lens is inserted, its axis should intersect the point of intersection of the two diagonals of the plate. The object of raising or lowering the lens is to raise or lower the position of the view on the plate, and so include more or less sky or foreground.

It is necessary here to caution the amateur that when the position of the lens is moved out of the centre of the plate dark corners will be produced, unless the illuminated circle given by the lens is sufficiently large; with many makes of objectives it will therefore be necessary to choose one capable of covering a much larger plate than that employed.

It is often a convenience if the lens can also be moved laterally.

The next requirement of the camera is what is known as the "swing back"—an arrangement by which the plate can be tilted at an angle with the base-board, and so with the axis of the lens. This movement is extremely useful in landscape work, since it often allows a better general focus to be obtained; but in architectural subjects it is a necessity, since buildings are often too high to be included on the plate, even when the lens is raised, without tilting the

camera, and the moment the plate is moved out of the vertical plane, vertical lines in the subject will become inclined in the picture.

The rule that when the subject contains vertical lines the sensitive plate must be in a vertical plane, is one of the few rules that may never be infringed, except in cases when it is impossible to adhere to it, and in these cases a great deal of trouble is entailed in copying afterwards in order to remedy the defect.

We have spoken only of an arrangement by which the plate may be kept vertical although the camera is tilted; but a second arrangement, by which the plate may be swung on a vertical axis, and so placed at an angle with the vertical plane passing through the axis —known as a "horizontal swing back"—is often of great use in street- and similar views.

An arrangement of great convenience is that known as the "reversing back." In the older patterns of camera, it was usual to unscrew the camera from the tripod and to attach it by its side, when it was advisable to take a vertical view; this method was clumsy and inconvenient, and could not be performed rapidly. The ingenuity of the camera-maker led to an arrangement whereby the frame carrying the dark slide and the focussing-screen could be reversed without any alteration in the position of the camera. This arrangement is of great convenience for plates which are nearly square, but since it entails the use of a square camera it is unadvisable in such sizes as $7\frac{1}{2} \times 5$ or 9×5, on account of the increase of bulk.

The camera should be rigid, in order to avoid trembling pictures, caused by the vibration of the shutter or by the wind. Lightness should be aimed at, provided it is not carried so far as to interfere with

rigidity or durability. Compactness, when packed for carrying, also adds to the convenience and pleasure of the operator, but should not be gained by taking the camera to pieces and packing one piece inside the other. The quality of the materials and workmanship employed are, of course, all-important. The question of cost is one for the consideration of the individual, but it should always be remembered that in cameras, as in most other things, the best are the cheapest, and these it is impossible to get, except at a fair price.

The tripod should be very firm, present little surface to the wind, should close compactly, and be as light as possible: it should always be provided with a turn-table.

The remainder of the necessary apparatus is such, that the common sense of the operator will be able to decide between what is good and what is bad.

The apparatus used for special purposes is described in the chapters referring more especially to its use, in order that the beginner's mind may not become confused.

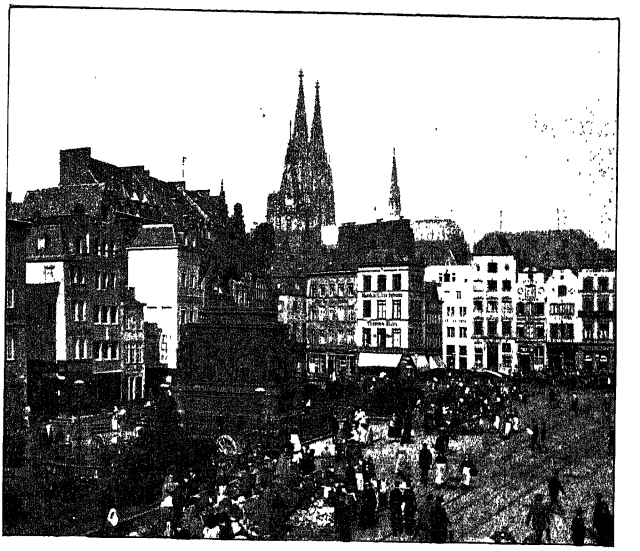
CHAPTER III.

COMPOSITION OF LANDSCAPE.

BEFORE dealing with this subject in detail, it will be well to consider what is understood by the term "composition." A great many people are under the impression that there are separate sets of well-defined rules of composition; one set applying to architecture, another to landscape, a third to the human figure, and so on. This is a mistake; the rules of art are identical, whether applied to a group of figures, a representation of buildings, or to any other subject.

Art is nothing more than the refinement of what is sometimes called "common sense," and is within the reach of all who will give a little thought to their work. Although all cannot attain the same measure of success, there is no reason why a result should not be produced, even by one not endowed with great artistic talent, which, if it does not rise to a sublime height, will at least not offend any of the common rules of good taste.

A certain writer has said that, in order to attain lucidity in literary composition, one should be sure he has an idea, and then proceed to express it in as few words as possible. This is precisely the advice we would give to anyone who is about to attempt a work of pictorial art. First let him be sure that he has some definite idea to depict, then try to express it in as simple a manner as possible. There could



No. 1.

No. 2.

PLATE I.

[Face page 26.

be no greater difference in style, in technique, or in the matter chosen, than is seen in the works of George Moreland and of Meissonier. The first frequently chose the most sordid subjects: pig-sties, stables, interiors of small inns, and the most commonplace incidents of country life; every picture gives evidence of having been finished with great haste, and with as little labour as possible; yet Moreland was a great artist. On the other hand, Meissonier chose subjects of the greatest dignity, and would crowd into one small canvas the work of a year. The reason both were great artists is that the work of a master is finished from the very beginning; and the aim of all pictorial art is to depict with breadth and simplicity the idea that is in the mind of the artist. This is what Moreland did; then, owing to his own peculiar habits of life he left his work in the state in which it has been handed down to us. On the other hand, Meissonier, having conceived the thought, composed his manner of interpreting it, then elaborated it, until as Ruskin says, "all trace of the means used to bring about the end had disappeared."

It is very certain that the study of the works of such an artist as Moreland must be of great service to the photographer. As we have stated, all photographs are pictures in monochrome, and the first consideration in composing such a picture is the subject of breadth. We will see how this is the case in the composition of a landscape.

In composition, the arrangement and proportions of the masses of light and shade are of primary importance. Most pictures in monochrome may be divided into a few distinct types, and their sub-divisions; for instance, there is the picture which consists of a large surface of shadow and deep half-tone, diversified by a

small amount of well defined light, this light occupying, as in our illustration, about one-eighth of the entire surface.

Then there is the opposite effect, a large surface of light and a small amount of well defined shadow. It is very certain the first will give a suggestion of an evening or night effect, and the second the character of being illumined by daylight. Rembrandt most frequently used the first combination, Turner the second.

Thirdly, there is the combination which is almost entirely delicate half-tone and light, with a very small amount of shadow. This effect may consist of a mass of half-tone upon a light ground, or of a patch of light upon a ground of half-tone.

Another picture may consist of two almost equal parts of light and shade, with very little half-tone at all, occupying opposite halves of the whole picture. Again, the subject may be divided into a dozen or more different parts of strong light, deep shade and half-tone.

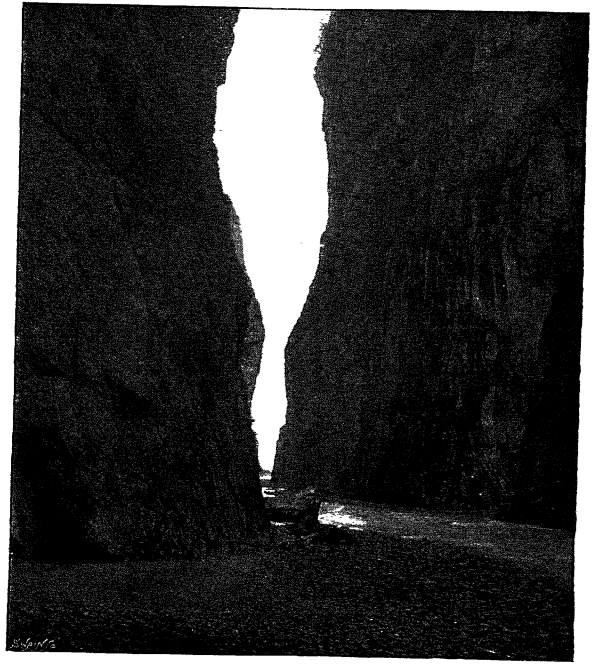
Of course there are many varieties of arrangement, but the fact remains that all are combinations of light, half-tone and shadow, distributed either in equal amounts, or one or two of them predominating.

It may not be superfluous to add that if the dark shadow occupies the greater part of the picture, a night effect will be produced. We have seen a photograph of a cricket-match, taken from a point about twelve feet above the ground, a hill forming the background: the figures of the players are very small white spots, all the rest of the picture is deep shade, the general effect resembles that of a star-lit sky. This is undoubtedly bad art, although it is technically a good photograph.

One of the first considerations in composing a picture to represent evening is repose, and this can only be attained by treating the subject broadly and

PLATE II.

No. 1.



No. 2.

[Face page 28.

quietly. As the poet Gray says in the "Elegy composed in a Country Churchyard":—

"Now fades the glimmering landscape from the sight."

Let us examine a simple illustration: The last rays of the sun are falling upon the church tower, which, being thrown into strong shadow against the brightest light, becomes the centre of interest, and the mind is led at once to the quiet curfew hour.

In the third of the combinations mentioned, we have a mass of delicate half-tone upon a ground of light: this will suggest daylight and distance, and whatever may be introduced into the foreground will have the effect of throwing the distance farther back. Care must be taken if the picture is to be that of an island, seen across a body of water, that whatever is put into the foreground must not be obtrusive, nor of any vital interest, as would be a boat being pulled with oars, or any object suggesting life; in order that the attention may not be fixed upon it instead of upon the island, which was the original and principal subject.

Another picture might be taken in broad sunlight, in the open country; if in this case there be a clump of trees at one side of the picture, as in many of the works of Constable, let the other part of the picture have some interesting bit of distance, such as the roofs of a village, as well as some object of quiet interest in the middle distance, a group of cattle, for instance; by this means the trees will not be constituted the centre of interest. On the other hand, if a photograph of a clump of trees is desired, let them occupy the centre of the picture, and have no very interesting object between them and the camera.

If the subject be a view on the sea-shore, the camera turned towards the water, a dark sky with long lines of light lying close to and parallel with the horizon, the

effect will be reproduced by reflection in the water, and the monotony of the lines may be agreeably diversified by the introduction of some vertical mass of darkness in the middle distance: each will act as a foil to the other, and each will serve both to emphasize and to relieve the other.

We will now consider the pictures we have chosen as illustrations, and endeavour to point out why they have been chosen, what they illustrate, and the principles underlying their composition. In the case of Plate I. No. 2 we have a view taken near Andermatt, on the road from Göschenen to Hospenthal, in Switzerland.

The purpose in taking this photograph was originally to show only the church, which is in the centre of the picture. If we had come close up to the church its image would have been larger, and the mountains amongst which it stands would have been dwarfed; would not, in fact, have appeared as mountains at all, they would simply have been seen as any small hill would, a dark background to the church, and any comparison of relative sizes would have been impossible. If, on the other hand, we had gone much further back, the proportions would have been truer, we should have been able to show the tops of the mountains, and the exact proportions of church and mountains would have been evident, but that would have been, not a picture of the church, but a panorama of mountain scenery. The result is a compromise between the two: there is enough of the surroundings introduced to show that it is a church in a mountain village; we are near enough to distinguish the style of architecture, the chalet in the foreground tells us it is Swiss, and so the direct purpose of the photograph is served.

The picture is broken into two principal masses, one of deep half-tone and one of light, the mountain-side forming the background and the sky. The sky could not appear above the centre of the picture owing to the circumstances under which it was taken, and as the mass of light which forms the sky occupies one corner of the photograph, it was advisable to have some object in the opposite corner to maintain the interest. The church itself coming in the centre concentrates the interest, as was intended, while the chalets, the sky, and the more minute details, prevent its being a solitary patch. The chalets in the lower corner of the picture play also another part in the composition; a church suggests at once the idea of worshippers, which the inclusion of the chalets undoubtedly sustains.

It is not necessary that the design of a composition should be too evident, unless it is intentional, in order to emphasize something of importance. This picture is exactly as it left the dark-room, nothing has been added or taken away, and is a suitable example of a quiet style of composition, simple and effective, the primary object being to take a photograph of a Swiss mountain church.

The subject of Plate III. is one of the smaller canals in Venice, the purpose being to show a certain amount of depth in the picture. It is not a picture of water, or of buildings, or of buildings and water, because that could have been obtained by taking any view which would have shown both: for instance, a view taken from directly in front of a building with the water in the foreground would have been sufficient.

Every one is aware how in perspective lines which are really parallel converge to a centre, as in looking down a street the houses appear to become smaller, and to stand closer together. This principle of per-

spective is easily observed in the case of a railway tunnel, or even the rails themselves. If one stands near or between the rails they seem to approach nearer and nearer together as they get further away, until at length they appear, if they are visible for a sufficient distance, to actually meet.

In our illustration, the object was to give an idea of depth and distance. If a view had been taken in an ordinary street, the lines of the houses might have been the same, but we should not have had so perfect an illustration, because the repetition of the lines, such as we have in this case in the water, would have been absent. If the point of sight had been in the centre of the picture the result would not have been so good, the design would have been too self evident, and nothing would have been possible to relieve it; as it is, we have two long lines which intersect each other at the point of sight, which is not in the centre; and in order to balance that deviation, and keep the interest central, the man in the boat was introduced. He is not accidental; he was specially introduced, and instructed just where to stand, so as to lend a little animation to the scene, and maintain the interest of the composition, which, as will be seen, consists of two large masses of half-tone and shadow and two large masses of light, the lower one of which is darker than the upper. In such a case it would be particularly bad art to introduce clouds into the sky by combination painting. The sky, being always the source of light, is always lighter than any other part of the picture, and in this particular instance there is just enough to emphasize the gloom of these streets without its occupying so much of the whole as to produce flatness and hardness.

We have in Plate VIII. another view in Venice. In this instance the picture is broken up into nearly equal proportions of light, half-tone and shadow, and is taken as an illustration of the necessity for divesting one's mind of all consciousness of colour before selecting the point from which to photograph. The church and custom-house in the centre of the picture appeared blue, or a very bluish grey, while the buildings at the two sides were very decidedly red. If we had gone farther back, or had taken our picture from a higher point of sight, we should have got an enormous patch of white for the sky, another to represent the lights reflected from the sky on the water, and across the centre would have been a strip of half-tone extending to the two sides. Such an effect would be irritating to the eyes, and when divested of its colour would be positively ugly. As it is, the equality of the masses is sufficient to give a suggestion of breadth and repose. This photograph was taken at five o'clock in the morning, before the great traffic of the canal began.

Plate IV. is an illustration of a picture consisting of deep half-tone and shade with very little light. This is a case where the interest is vested in large masses of shadow upon a ground of deep half-tone, and is only possible where the shapes are clean and well defined. If instead of ships the dark parts had been trees, and instead of the water we had had grass, the arrangement would not have been suitable; the trees would have been muddles, and there would have been no reflections to clear up the shapes. As it is, the light of the sky reflected upon the wavelets relieves that part of the picture.

This picture would have been better if the light

portion of sky had not been so high, but much nearer to the horizon. This photograph cannot be regarded as very good in composition, since the interest is too much divided. The effect is greatly owing to the insufficient exposure of the foreground. If it had been possible to have exposed the foreground more, keeping the sky the same, the contrast would have been less, and it could have been printed to the requisite depth.

Plate I. No. 1 was chosen to illustrate the fact that where a picture is broken up into a very large number of small masses of light, half-tone and shade, they should extend completely over the surface, and should be approximately equal in interest as in size. This picture represents a public square in Cologne with the Cathedral in the background.

Plate VI. No. 2 is probably a better illustration of the distribution of the masses of light, shade, and half-tone when they are small and of no special interest separately. This photograph, taken in January, 1895, represents the Thames at Hammersmith.

In the case of Plate II. No. 1 we have a good illustration of composition of line as well as of mass. It has always been an object with architects to design a building so that its outline against the sky should be good when seen from any point. In the present illustration we had great difficulties to contend with; we could not get far enough back to show the building as the architect intended it to be seen, consequently we had to use a lens of very short focus, or we should not have had the top of the spire and towers in the picture at all. Having to use such a lens, the relative heights of the spire and towers was destroyed owing to the greater prominence of the nearer tower; all the rest of the building is subject to the same distortion. All we

could do was to walk round and choose the best point obtainable from which to take a view of the western end of the building. We give in Plate XXV. an example of similar distortion, as well as a second reproduction in which the distortion has been corrected. The method employed is fully described in Chapter XII. All that could be done was to let the top of the spire almost touch the top of the picture. It will be noticed that this picture consists of one large well defined mass of half-tone and shade upon a light ground. Had the building been lowered in the picture two effects would have been produced, the height would have appeared less owing to the greater amount of sky above the spire, and the whole edifice would have had an appearance of instability, since it would have appeared to be standing on almost nothing.

Both of these last considerations are of vital importance; in all architectural compositions it is essential that there should be a suggestion of a good broad base of masonry, or, at least, the foreground should not be dwarfed; too much is better than too little.

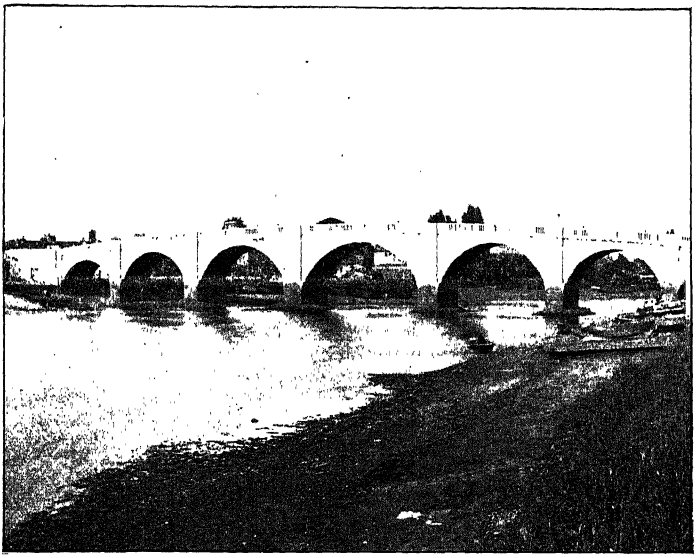
Plate IX. Nos. 1 and 2 afford illustrations of the same type of subject treated differently. In the one we have a church and other buildings seen across a body of water, and in this instance the highest light and the deepest shadow are close together near the centre of the picture. The surroundings in general are very light half-tone. In No. 2 we have the same subject treated in a different manner. In this instance the buildings are a simple patch of darkness upon a ground of deep half-tone, somewhat broken up in the sky by clouds and on the water by reflections. In the first of these two pictures a boat might have been introduced, with advantage, into the foreground, which is

rather bare; this would have had the effect of diminishing the buildings by contrast.

Here we have an illustration of the danger of combination printing, unless done very judiciously. There is probably little need to say that the water reflects the sky as well as the buildings. If a sky with clouds had been printed in to relieve the bareness of that which is there, it would have been quite impossible to so treat the water as to render it even approximately correct. Even if this were not only impossible but easy, such a proceeding brings the work under the head of drawing; it is no longer a photograph; as nine-carat gold can hardly be considered gold at all, there being more alloy than pure metal, so a photograph that is mostly retouching ceases to be a photograph and becomes a drawing; combination printing is in such cases retouching. Still there are cases when it is a great help, and when careful consideration will enable it to be used with great advantage.

The first is a type of picture which consists of a mass of light and shade occupying the centre. This mass is clean, hard, and well defined in shape. The principal building, the church, should be nearly, though not necessarily quite, in the centre.

The second is of altogether another type: it consists of a mass of darkness, which occupies the centre of a mass of slightly diversified half-tone, and owes its interest solely to its outline; when that is very good little in the way of detail is needed to help it; it would, in fact, not be a help. This picture is not so hard as the last, although the shadow is deeper and the detail less. It is relieved by the clouds and the reflection in the water, which serve to soften it, and although the principal mass is so dark the general tone is still deeper.



No. 1.

No. 2.

PLATE VI. [Face page 36.

Plate VII. No. 1 represents a group of fish dealers on Brighton beach. This picture is a type of those where the centre is filled with a mass of deep half-tone broken up by lights. This mass covers one-third of the whole surface, is soft and varied in outline. It would not have been good to have had another figure, or any large object between this group and the camera, as there is no need for it. The motive of this picture is a crowd; small in number and quiet in action; it would be bad to bring anything into it which would distract the attention, unless it was so marked as to itself constitute the chief interest.

If we examine any well known picture, such as "The Derby Day," by Frith, at a first glance, it appears as a crowd of people all having the same interest and value in the composition, but a little closer attention will show us that this is not the case, it is really a large number of small crowds, each separate in character, and only united by the most slender threads.

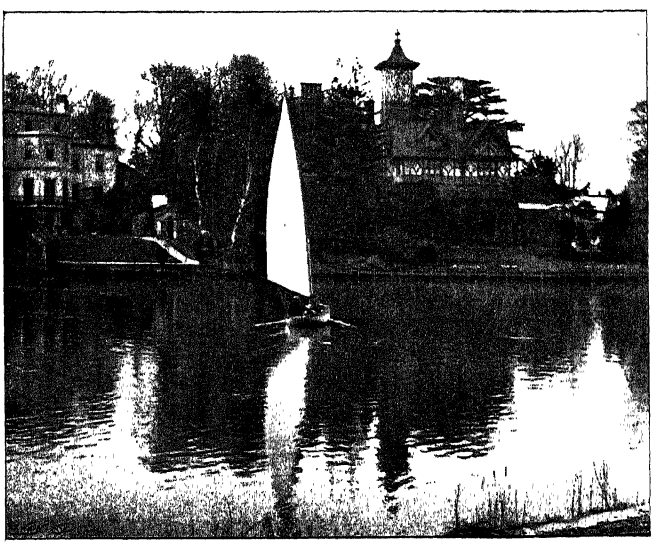
The frescoes (by Sir Frederick Leighton) on the walls of the South Kensington Museum are types of a similar character, they represent crowds. "The Arts as applied to Peace," for example, is a crowd of people, but there are many separate and diversified groups—the women sewing, the men bringing in earthenware vessels, the ladies trying the effect of certain costumes, etc. One of the great beauties of these pictures is the art with which the groups have been kept separate without any very great division being apparent. For instance, in the "Derby Day," there is no great open space between the carriages and the group of acrobats; the centre of the picture is kept somewhat open, because the two sides are occupied with certain groups which are of equal value and interest, and if it had not

been kept open the crowd might have represented almost anything; it was necessary here that we should be able to look into the depth of the picture to identify it as the Epsom Race Course. It will be found difficult to find a crowd which is all actuated by the same impulse, unless we take such crowds as may be seen from across a race-course at a moment when the horses are near; all heads will probably, at such a moment, be turned the same way at least, and there will be very little variety of incident. If we examine some of the crowds drawn in our illustrated papers, we shall see that except the principal groups, possibly some members of the Royal Family and one or two attendants, which may be drawn with some regard to accuracy and with some little attempt at arrangement, the remainder consists generally of heads without bodies, heads and bodies without legs; in other words simply packing put in to fill space.

Plate V. No. 1 is an illustration of a very common type of photograph, a type which, however, is very frequently badly arranged through lack of a little judgment. When a picture is broken up, as in the present instance, into two equal divisions of light and shade, it is necessary that the principal interest should be centred on the line which divides them; this may always be attained by selection. Some striking object (such as is seen in the fir-tree, which appears strongly defined against the white sky, a group of cattle, or some interesting building with a good outline would be suitable) should occupy a prominent position on this line. The outline of the darkness is also the outline of the light, the value of each being about equal.

If such an arrangement were in a different key, the shade much lighter, and with more detail, for example,

No. 1.



No. 2.

PLATE VII. [Face page 38.

it would be a good opportunity to print in a sky with clouds so that the balance of interest might be maintained. But even in this case it is necessary to be very careful what sort of sky to select; a mass of dark stormy clouds would not harmonize with a picnic party or similar subject in the lower part of the picture. The character of the sky chosen should also be regulated by the predominant lines and masses in the lower part. If the sky is full of clouds driven into long lines by a high wind, these lines should not run parallel with the line that divides the two principal masses of the picture, but should oppose it somewhat; thus if the dividing line is at an angle of about 20° with the bottom of the picture, and slopes downwards from right to left, the lines of the clouds or the general direction of their masses should have a somewhat similar inclination from left to right, and the most marked of their shapes should be near the dividing line; by this means concentration of interest will be maintained; and if the detail of the darker portion has to be deliberately arranged, and is not the result of accident, care must be taken that it does not extend with undiminished value to the extreme corners. A group of people should not cover the whole of the lower space, or confusion will be the result.

Many writers have directed the student to take for his models such artists as Wilkie, Maclise, and others, men whose pictures abound in large groups of figures, such as the "Blind Fiddler," by Wilkie, a composition of ten figures. Anyone who has had any experience in posing for photography must be aware of the very great difficulty in properly arranging two figures; how much more difficult must it be when the group consists of six or more.

Such advice is misleading, it is sure to be attended with failure; it is far better to endeavour to attain breadth and simplicity, which is a matter of quite sufficient difficulty. A few visits to the South Kensington Museum, where one may examine some of the preliminary studies made by such men as Maclise, will show that these artists were aware of the magnitude of their undertaking when they began a picture containing many figures; if a great artist with all the necessary means at his command, models, drapery, accessories, great ability, and above all, time, if such an artist found it necessary to make not one, but a dozen elaborate studies before deciding upon the arrangement of his groups, how necessary is it for a photographer to be moderate in his ambition, and not attempt that which can only display his want of knowledge.

We would rather say, study the works of George Moreland, Millett, Colin Hunter, and others, who obtain their effects with a very few figures. What could be more impressive than "The Angelus," by Millett? It is simplicity itself, a quiet evening sky, an open field, the figures of two peasants with bowed heads; there is nothing more in the picture; it owes its charm and merit to the simple artistic feeling which pervades the whole. The story of a life is suggested, and this suggestion is much stronger in its simplicity than would have been any weak attempt at a grander composition.

It should always be borne in mind that the same difficulties which exist in photography do not exist to the same degree in painting, although it is far more difficult to paint well than to photograph well.

Plate VII. No. 2 is an instance of inferior com-

position. It consists of a large, well-defined mass of deep half-tone upon a light ground, with a small patch of bright light in the centre. This might have been much better if the boat had been nearer to the camera, for instance, since it would have been much larger, and the upper part of the sail would have cut through the outline of the trees and buildings which form the background. Being contained as it is within that outline it conveys an impression of weakness; the mass of the background then becomes the predominant interest, or at least is as important as the boat; which is bad. This picture has been introduced to point out a very common defect.

Plate VI. No. 1, which represents Kew Bridge, may be taken as an example of a comparatively light, flat ground, diversified by a broken line of light and shade, and is illustrative of a rule that is sometimes insisted upon, that the highest light and the deepest shadow should be near to one another. This rule is good when used in moderation, but it is very easy to carry it to excess; it then becomes theatrical.

The late Gustave Doré was very much addicted to strong contrasts of light and shade. In one of his illustrations of the Bible, "The Earth after the Deluge," there is a deep gorge between two hills with a mass of water rushing down it. The sides of the hills are covered with the bodies of the drowned. The Ark rests upon the mount in the background, the space between the hills is very dark, in fact the darkest part of the picture, and right in the centre of this we see the dove, a small patch of intense white. There is no very great subtlety about such a composition, all the facts are there in their regular order, but the design is very apparent.

Plate II. No. 2 is an illustration of an entirely different idea. It has frequently been said that a suggestion is often stronger than a bare fact, and in all works on design it is insisted that a composition should contain the element of mystery; this is not always possible, nor even desirable, in photographic composition. There can be very little that is mysterious in some of the subjects which we have to photograph, but the element of mystery can be introduced in very simple compositions, it exists in a single line; for example, that which is called "Hogarth's line of grace and beauty," the mystery is in its ever-changing character. A circle has a plain regular curve, the centre is self-evident. A parabola can be measured when it is certain what its start is ruled by. Christopher Dresser, in his work on "Truth, Beauty, and Power," uses for a frontispiece a design for a ceiling which at first sight appears a harmonious arrangement of small masses of colour, each having no particular shape. But on examination they are found to consist of the bones and feathers of birds; the design is very involved, like a pavement in a building of the Mohammedan style, and its constituent parts can only be identified on very close examination.

This picture, which was taken just inside the entrance to the Gorge of Trient, in the Valley of the Rhone, is intended to convey two impressions, one the character of the gorge itself, and another a suggestion of what might be outside it. If the camera had been stood in front of the opening, all that would have been seen would have been a dark streak down the face of the mountain, this would not have conveyed any idea of the subject. If the Gorge had been photographed from within, with the camera turned from the opening,

and the lens pointing inwards, a very dark picture would have been the result, and it would have contained nothing that could suggest its size. As it is, a strong impression of the depth of the cleft is conveyed by the fact that its top is beyond the upper line of the picture, while the glimpse we have of the snow-covered mountains and the sunlit valley, suggests unknown possibilities of warmth and light outside the confines of this gloomy crack in the earth. No photograph could convey any idea of the extent of the Gorge, as it is seven miles long; it was best to represent the first impression after leaving the light and warmth of the valley; in other respects the picture is very simple, a patch of strong light in the centre of a mass of darkness.

It would be easy to fill a book with illustrations of compositions, taking the works of great painters as the material, analyzing them, and pointing out the apparent motive in each work; but this is open to one great objection, the painter may modify and alter any detail which does not meet his approval, and so arrive at the result he wishes in a manner that is not open to the photographer, who, on the contrary, is compelled to accept whatever is before him, and although he may select his subject, and exercise his judgment in deciding from what point it is to be taken, yet the fact always remains that what is actually there is what will appear in the photograph; it has, therefore, been thought the better plan to illustrate only with photographs, to mention the object and purpose of each, and thus indicate some of the facts that rule every work of pictorial art. Subjects of the greatest simplicity have been chosen, each having strongly marked characteristics, but they are by no means to be

taken as the limits of the possibilities of landscape photography.

We are of opinion that it is better to show a few of the elementary constituents of a picture than to lay down arbitrary rules for the guidance of the student. Each must be guided by his own taste as to the type of photograph which he will attempt; one will take his camera into the country, and will look for certain effects, another will go to the same place with a totally different set of ideas; each may be right, and each may produce a very good piece of work. We would draw attention to one fact that is frequently overlooked by photographers. A photograph must be measured by two standards, by that of the artistic feeling and taste it may display, and by its technical merit. The latter may very often be considered as subordinate to the former.

A certain class of photographers hold that a photograph should contain such and such a proportion of high light, half-tone and shadow, that the distinction between each should be strongly marked, and that without this it is not good; we do not hold this opinion; a photograph, like every other work of art, should be considered to convey an idea; if it conveys that idea it is good, the more perfect it is technically the better, but its technical perfection is very often not the chief consideration.

We should make this clearer by pointing out a great change that has come over the manufacture of objectives. At one time a photograph was not considered to be good unless it was absolutely sharp all over; then the portrait lens was introduced, which limited the field of perfect focus, or that which is accepted as perfect focus; a portrait lens will take a head and

shoulders relatively sharp all over, but anything in front of or behind this plane will be soft and out of focus; this serves the purpose of concentrating the interest upon important parts of the subjects and allowing others, such as the background, to sink into their proper places. A painted background which is as sharp as the face or figure is obtrusive, and destroys all atmosphere in the picture.

In the last few years another idea has taken the place of the old one: a portrait lens is now made which will enable us to take a photograph which is not sharp anywhere, and this is considered better from an artistic point of view. An artist, when he paints a landscape, does not attempt to reproduce every leaf and every blade of grass; there would be no end to such work, a square yard of turf would furnish employment for a life-time. A portrait painter does not draw every hair, he takes the masses that appear most evident, and is satisfied if he produces the same effect upon the mind of the observer as the subject did upon his own.

In landscape photography, as in portraiture, whatever is sharp will attract the attention, and atmospheric effect can only be got by a certain amount of want of definition.

CHAPTER IV.

EXPOSURE AND DEVELOPMENT.

THE production of a technically perfect negative requires at the outset a correct exposure in the camera; the determination of this exposure involves a correct estimation of the actinic value of the light at the moment of exposure, a knowledge of the rapidity of the plate used, and of the lens aperture; the two latter factors are at once known, since the rapidity of the plate is, or should be, stated by the maker, and the stops used should be marked with the ratio of their diameter to the focal length of the lens.

Most photographers have an idea that under and over exposure can be corrected by modifications in the method of development; but this idea is absolutely erroneous; the ratio of the various opacities produced in the negative by light of greater or less intensity, proceeding from various parts of the subject, remains, generally speaking, constant, whatever the method of development; provided that the developer is used in sufficient quantity and for a sufficient and equal time on all parts of the plate. The only difference that straightforward development can make will be in what we will call the *pitch* of opacities; that is to say, just as in music the various notes of one octave bear exactly the same relations to one another as similar notes in an octave of lower or higher pitch: so

in the case of our negative, the opacity of the various portions will bear the same relation to one another, whether it be "thin" or whether it be "dense."

Generally speaking, the correct exposure is that which will produce such an effect upon the plate as with normal development will just cause sufficient opacity in the high light to prevent any tint whatever being shown in the print, whilst at the same time the deepest shadows, and these only, remain clear glass.

The recent researches of Messrs. Hurter and Driffield have shown that where the light increases in a geometrical progression the density (measured by the amount of silver reduced) increases in an arithmetical progression, but that the resulting opacity (commonly called "density" by photographers) increases, like the light, in a geometrical progression. The density resulting from different intensities of light action may be plotted as a curve. It is found that this curve consists of three parts, corresponding with under, correct, and over exposure. The first part, that belonging to under exposure, shows very clearly what we know from experience to be the fact, viz.: that the high lights attain a degree of opacity entirely disproportionate to that of the half-tones and shadows; the third part, that belonging to over exposure, shows us what we also know to be true, that the high light and half-tones will be almost of the same opacity. The second portion of the curve, with which we are more nearly concerned, we find to consist of a straight line more or less inclined, according to the "pitch" to which development has been carried.

We give in the Appendix[1] the curves of density and opacity for two brands of plate of very different

[1] Appendix E.

character: curve No. 1 belonging to a Marion's "Ordinary" plate, and No. 2 belonging to a Cadett "Lightning" plate. The speed of the two plates, as determined by the H. and D. system, is No. 1, 58; No. 2, 94.

In making the above statement that only a correct exposure would produce a perfect negative, we assumed that this perfection consisted of the exact representation of the intensity of the light reflected from various portions of the subject; but in many cases the plate is not capable of representing so large a range of intensity; for instance, in the Swiss scene which we described in our introduction a compromise must be effected; at any rate when using any brand of plate with which we are at present acquainted; for the difference in the intensity of the light reflected from various parts of the subject is so great that if our exposure be correct for the high lights of the view, the darker portions will be hopelessly under exposed, and will lack detail: whereas if, on the contrary, the exposure be correct for the darker parts of the picture, the lighter portions will be greatly over exposed. This is to a great extent the fault of plates; were they more rich in the sensitive compound they would be capable of representing correctly a greater range of light intensities.

The practical estimation of what will be a correct exposure in any particular case is, and always has been, one of the great difficulties of the photographer; it has been more or less successfully met by the invention of numerous photometers, actinometers, etc., which have professed to measure the value of the light at any particular time, but we have not yet come across one which has successfully solved the problem.

They may be divided roughly into two classes, both essentially wrong in principle, since the first owes its action to the visible effect of light on silver chloride, which differs materially from its effect on the sensitive compounds used in the production of negatives; and the second class, whilst forming, perhaps, a correct estimation of the value of light to the eye, does not take into account its colour or photographic value.

The only instrument in which we can place any confidence whatever is that recently invented by Messrs. Hurter and Driffield, and known as the Actinograph. It does not profess in any way to measure the value of the light, but is simply a machine for calculating what the exposure would be on an open landscape at any time, on any particular day, under certain hypothetical conditions. The basis from which it calculates is that of the light resulting from the altitude of the sun in a perfectly clear atmosphere.

Whilst this instrument does not in any way do away with the necessity for thought and judgment, it enables a very close approximation to correct exposure to be made, even without the assistance of extended experience.

Closely associated with the question of exposure is that of the properties and capability of the plates we are in the habit of using, and we should certainly advise that a few simple tests should be made to determine not only their rapidity, but their range; that is to say, the minimum amount of light which they are capable of representing while at the same time not rendering the high light too opaque. We have examined many brands of plates, some supposed to be of great rapidity, and have found that, as a general

rule, the greater the rapidity the smaller has been the range.

Let a glass plate be ruled off in squares, and, leaving one square vacant, let the others be covered with translucent paper, the number of thicknesses of paper increasing by one at each square. If a sensitive plate be exposed under this in a printing frame to the light of a candle, and then developed, so that where the plate has been covered by the clear glass square it shall be just so opaque as to leave white paper in printing, it will be found that a greater or smaller number of the squares are now shown on the plate, the greater the number of squares shown by a tint before clear glass is reached the better, *cæteris paribus*, will be the plate.

In speaking of lenses we have explained the influence of the diaphragm in producing greater marginal sharpness and in increasing depth of focus. It will be easily understood that as the aperture through which the light has to pass is reduced the exposure must be engthened, and it is not difficult to understand that when the diameter is reduced to, say one half, that the exposure is increased four times, since the area of a circle is proportional to the square of its diameter, and the light admitted is proportional to the area through which it passes, or in other words to that of the diaphragm opening.

It is, perhaps, not quite so easy to appreciate that the exposure will be the same for all objectives when used with stops of corresponding diameters (neglecting the slight difference caused by the varying number of lenses mounted together); that is to say, that if we take an objective of 18″ focus with, say, a stop of 1½″ opening, we shall require the same

exposure as with a similar lens of 9″ focus and a stop of $\frac{3}{4}$″ diameter.

Although this fact may be proved with great facility by experiment, the theoretical proof is neither long nor difficult. It has been explained in the portion of this work dealing with lenses that the size of the image of any object produced on the ground-glass depends simply on the focal length of the lens employed; a lens of 18″ focus will produce an image twice as large, in linear measurement, as that produced by a lens of 9″ focus, but the area of this image will be four times as large in one case as in the other; that is to say, that the light reflected by the object is spread over four times as great an area in the case of the 18″ focus as in that of the 9″; the aperture being in each case the same factor of the focal length in diameter, will, therefore, have an area also of four in the one case and of one in the other; so that both the area over which the light is spread to form the image and the area through which the light is admitted, or more simply the amount of light, vary in the same proportion; the light at any point on the plate will, therefore, have the same intensity in the two cases.

The amateur is, as a rule, recommended to carry a note-book with him, and to book down at once the particulars of each exposure as a guide to development, the method of development being settled at the time of development. This practice is of little use; and we strongly advise that instead of making notes of the time of exposure, the size of stop, etc., the amateur should insert in his note-book the number of the slide, a short description of the scene, and should decide on the spot the method of development, inserting this in his note-book, at the same time indicating any partic-

lar difficulty which is likely to arise or any special effect which is to be produced.

We do not say that the insertion of the usual particulars is useless for all purposes, but it is entirely useless as an aid to successful development.

We insert here, for the sake of clearness, a contracted page from our own note-book :—

Date	Plate	Name	No. of Slide	Description	Development	Notes	Result	No. of Neg.
1/6/95	Rapid			Clouds, snow, deep shadows, lake.	Slow, out of dish	Reduce contrast	Good	

These entries recall the scene clearly to the mind, and show plainly the method required in development.

The amateur often neglects one of the most important points in connection with exposure; that is, he does not take the trouble to learn what a correctly exposed negative looks like, and thus he works along in the dark, and learns to consider a *fair* negative *correctly* exposed, whereas it may be very far from correctly exposed. He should let one of his first duties be the production of a correctly exposed negative, and to this end he will do well to expose as many as half-a-dozen plates on the same scene. Let him stop down to a fairly small aperture. until he judges, in fact, that an exposure of about four seconds will be required; then let him expose half-a-dozen plates, commencing with an exposure of one second and exposing each plate a second more than the one before it, until the fifth plate is reached, when an increase of two seconds should be adopted; in this way he will be almost certain to get one exposure within the limits of what may be

called correct exposure. If these plates be now developed with ferrous oxalate, as described later, and all in the same manner and for the same length of time, he will find that one will stand out by its clearness, its crispness, and its opacity, together with its abundance of detail, from the others; this one is correctly exposed. Such an expenditure of plates, he will soon find, is not a waste, as it will teach him more about exposure than any number of pages of printed instructions.

Before leaving, for the present, the subject of exposure, let us impress upon the beginner that, when he has chosen his subject and determined what exposure ought to be given, to expose only one plate upon it, and to give to that plate exactly the predetermined exposure; he will, in this way, learn to rely upon himself, and will not get into the pernicious habit of underrating his own judgment. We have met many photographers, both professional and amateur, who will not take the trouble to think seriously about their exposure; they guess that one second will be about right, and then proceed to expose two plates, one for ½ second and the other for 1½ seconds. The result of this mode of procedure is that they never learn to judge an exposure accurately, and seldom, if ever, produce a correctly exposed negative.[1]

As a guide to the beginner, we have calculated, by the Hurter and Driffield system, a number of exposures, which are inserted in the form of a table in the Appendix.

The subject of developers and development is a very

[1] It will be found that if the principle of exposing only one plate be adopted a considerable saving will accrue, but the most important consideration is that when travelling, plates will require changing less often, a great advantage.

broad one, and one which forms the almost constant subject of conversation among photographers; yet it is extremely simple in most cases. There is no magic attached to any particular developer; each has its own special qualities, each is more suited than another to certain special purposes. But the resulting negative depends far less on the developer employed than on the operator.

In our own opinion there is no developer so suited to the requirements of the amateur as the concentrated ferrous oxalate recommended by Captain Abney; it yields negatives of a good colour, clean in the shadows, and, therefore, rapid in printing; it is easily managed, and the complaint raised against it so frequently that density is difficult to obtain has no foundation in fact. The only drawback that we have found to its use is that the effects of under or over exposure are more pronounced than is the case with many other developers. This is not, in our opinion, a very serious matter, since it causes an effort to be made to secure an exposure as nearly correct as possible, and whatever developer is employed, a really good negative can only result from an approximately correct exposure.

This developer should be prepared by making a cold saturated solution of neutral potassium oxalate in distilled water. The solution may be made by the aid of heat and then allowed to cool, when the saturation is at once shown by the crystallizing out of some of the oxalate. To this solution ferrous oxalate—which can be obtained in the form of a yellow powder from any photographic chemist—is added, with shaking, until after shaking and standing a slight amount of the yellow powder remains undissolved; the clear solution, which is of a deep red colour, can be decanted off, or

filtration may be adopted. The solution is best preserved from atmospheric influences by being placed in small bottles, and well corked.

For use, the solution is diluted with an equal bulk of water, and one or two drops of a 10 per cent. solution of potassium bromide added to each ounce.

The plate, after being taken out of the dark slide, is dusted with a camel-hair brush, placed film up in the developing dish, and the solution poured on; the dish should then be gently rocked for a few seconds and covered up. The plate should remain in this solution until all detail is visible, when it should be removed to another dish containing undiluted ferrous oxalate solution with five or six drops of the 10 per cent. bromide solution per ounce; this will bring up the density; the plate, if the film is of moderate thickness, should remain in the developer till the image appears pretty clearly on the back, when the opacity will generally be sufficient.[1]

If the image only appears slowly on the application of the developer, about ten drops of a 10 per cent. solution of sodium hyposulphite should be added to each ounce of the developer, when, if the plate is not much under-exposed, the detail should come up, and density can then be obtained by the concentrated solution.

If, however, the image comes up too rapidly, the developer should be at once poured off and the plate rinsed; the plate may then be soaked in a dilute solution of bromide, or as much as ten drops of the 10 per cent. bromide solution may be added to each ounce of the developer; when the developer is again flowed

[1] With some plates a marbled appearance will result, unless the dish is rocked during the whole period of development.

over the plate the image should develop up clear and strong. In this case it will, in all probability, not be necessary to use the concentrated solution to gain density.

We have remarked above that the ferrous oxalate developer will not produce such good results from under or over-exposed plates as many other developers; but if the plate be so nearly correctly exposed as to produce a good negative with any other developer, it will do so by the above method; and, in fact, a plate which will not develop by ferrous oxalate should, in our opinion, be placed on one side as useless.

As soon as the development is complete, the plate should be well rinsed and placed in an alum bath (cold saturated solution) in order to decompose any calcium oxalate caused by lime in the washing water.

After a few minutes' insertion in the alum, the plate is again well rinsed and fixed in hyposulphite of soda (6 ozs. hypo. to 20 ozs. water). The completion of the fixing operation can be judged by looking at the back of the plate, which should have lost its white or greenish appearance, and look black.

We consider it of importance that negatives should be fixed in the dark room, since, although after ferrous oxalate development and the use of the alum bath it is not essential, yet with many developers fog and stains will result from a strong light reaching the plate before fixation is practically complete.

Pyrogallic acid is a developer which finds greater favour with most, and yields excellent results when intelligently employed. We have already treated of the chemical reactions taking place during development, and shall now refer to the practical side of the question.

We have three agents which we are going to use, the developer proper, the accelerator, and the restrainer. Of these two the developer and the accelerator are essential in all cases, whereas the restrainer is used as a matter of convenience; on the proportions in which these three agents are employed to form the developer, and the time during which they are allowed to act depends the character of the resulting negative. By modifying their proportions and their time of action we can produce a negative full of detail but of no great opacity, or one of extreme opacity.

Pyrogallic acid alone is not satisfactory, as, though it will develop an image, it is only a feeble, ghostly image, and the time required for its production is prolonged, but in conjunction with an alkali, ammonia, carbonate or hydrate of soda or potash, for example, a vigorous image is rapidly developed.

If a strong solution of pyrogallic acid have added to it a small proportion only of alkali, and a properly exposed plate be immersed in the solution, it will be found to develop only slowly, and the negative will gain too great opacity in the high lights before the detail in the shadows appears; if, on the contrary, a too large proportion of alkali be added, the negative will develop with great rapidity, and whilst all detail will appear, it will lack opacity.

From the above it will be seen that the proper proportions are of great importance, and although most plate-makers suggest the proportions which they consider the best for their particular plate, we prefer to find the proper proportions from the way in which the image begins to develop in each case.

The restrainer which we have mentioned—potassium bromide is usually employed—serves more than one

purpose; it slows the action of the developer, and so allows more judgment to be exercised. But it also plays a more important part, in preventing or minimizing the reduction of the silver salt in those portions of the film which have not been affected by light, and so tends to keep the negative clean and free from fog; it also prevents to a great extent the general staining of the film. Although the addition of the bromide to the developer is not essential in the case of a correctly or under-exposed plate, its use is always advisable.

In the case of an approximately correct exposure, the developer should contain about three grains of pyro per ounce, as it has been found that this strength of solution will give the required opacity, and will at the same time work sufficiently slowly to allow the detail to appear in the shadows before the high lights become too opaque; and also to allow the opacity to be easily judged. A solution may be made of this strength, a few drops of nitric acid being added to prevent the oxidization of the pyro; or a saturated solution of sulphite of soda may be made, and the pyro added. Metabisulphite of soda or potash may be used instead of the sulphite, and is, perhaps, better, although more expensive, since it keeps better in the dry state than the sulphite, and is also a better preservative of the pyro in solution.

Our own practice is to use a semi-saturated solution of sulphite, and having poured the requisite quantity to cover a plate into the developing cup, to add the pyro in the dry state—the quantity can, with a little practice, be guessed with sufficient accuracy. The solution thus formed is flowed over the plate, and about five drops per ounce of 10 per cent. bromide solution dropped into a measure, together with what

is judged a sufficient quantity of alkali to develop the plate. One-half of this mixed solution is then poured into the developing cup, and the pyro solution poured off the plate into the cup: the developer is now flowed over the plate. The image should begin to appear in from thirty seconds to a minute, the detail coming out, and the plate gaining density; the addition of the remainder of the bromide and ammonia will, if the plate were correctly exposed, suffice to bring up the required opacity.

In the case of an over-exposed plate, the image will appear too rapidly after the application of the mixed developer. Should this be the case, the developer must at once be returned to the cup and the plate rinsed; more bromide should be added, together with an extra grain or two of pyro per ounce, and the developer returned to the plate, when development should proceed satisfactorily.

In the case of under-exposure, the plate may show no image whatever after the expiration of a minute or so, in which case the remainder of the ammonia previously put ready should be added to the developer, which should also be diluted by the addition of more sulphite solution or water. The image will, with this treatment, come up slowly, and gain density, and if the under-exposure has not been excessive, should give a fair negative.

The great secret of success by any method of development lies in the time occupied; and the greater the under-exposure, the greater the time required for development. As much as eight or ten hours is not too much to allow for extreme cases of under-exposure.

If a plate will not develop by the method above

described, it should, in ordinary cases, be laid aside as a failure, and, if possible, another exposure made.

In order to avoid confusing the details with the general principles of development, we have delayed giving any formulæ until the close of the chapter. We now, however, give two, which are intended for correctly exposed plates, and must be modified, as shown above, in cases of under or over-exposure.

PYRO-AMMONIA DEVELOPER.

Stock solution.

Pyrogallic acid, 1 oz.
Bromide of ammonium, 2½ oz.
Metabisulphite of potassium,[1] 1 oz.
Distilled water to make up to 10 oz.

Dissolve the metabisulphite in half the water, add other ingredients, and make up to quantity.

A. Stock solution, 300 minims.
Distilled water to 10 oz.
B. Liq. ammonia ·880, 70 minims.
Distilled water to 10 oz.

Use equal parts of A. and B. mixed at time of developing.

PYRO-SODA DEVELOPER.

A. Pyrogallic acid, 60 grs.
Potass. metabisulph.[1] 15 grs
Distilled water to 10 oz.
B. Washing soda, 600 grs.
Sulphite of soda, 800 grs.
Distilled water, 10 oz.

Use equal parts of A. and B. mixed at time of developing.

[1] *If sulphite is preferred, substitute 2½ grs. and ½ drop sulphuric acid for each grain of metabisulphite in above formulæ.*

Many developers of great value have recently been discovered, but as these agents are not so generally useful as the two described, although advantageous for certain special purposes, we shall defer any description of their uses until we treat of special cases.

The best known of these more recent agents are—hydrochinone, rodinal, eikonogen, metol, amidol, and glycin.

CHAPTER V.

COMPLETION AND PRESERVATION OF NEGATIVES.

As soon as the negative has been fixed, as explained in the last chapter, it must be washed, in order to free the film from any traces of sodium hyposulphite. The time required to extract the hyposulphite depends on the method employed in washing, and on the thickness of the film; with a film of ordinary thickness one hour in frequent changes, or, preferably, in running water, suffices: but with thicker films as much as two or three hours may be required. The elimination of the hyposulphite takes place more rapidly if the negative can be placed face downwards in the water. To do this a special dish is required, as, of course, the film must not come in contact with the bottom of the dish. Such a dish is easily formed from a dish of the ordinary kind by cementing four corner pieces either of glass or of wood well soaked in melted paraffin wax or in pitch, into the four corners, so that the negative may rest on them just at the corners and about a quarter of an inch from the bottom of the dish. There are also many excellent contrivances in the market for washing negatives. Whatever method is adopted, the secret of success lies in the use of plenty of water.

If it is required to wash a negative rapidly, our own practice is to rinse the hypo off the surface under the

tap, lay the plate down in a dish of clean water for five minutes, then take it out, and holding it in a stream of water from the tap, to rub the film well with the flat of the hand, and then put it in a dish of fresh water. If this operation is repeated three or four times the hypo is almost entirely eliminated, at any rate sufficiently so to allow the negative to be dried and printed from.

Later in this chapter we give instructions for the use of peroxide of hydrogen and other reagents, for more completely eliminating the hyposulphite.

When the negative has been sufficiently washed, it may be stood on edge in some place where there is a good draught, and which is free from dust; it will then dry in from two to eight hours. Convenient racks for this purpose are sold by all dealers. The completion of the drying process can be ascertained by looking across the negative, when it will be found that the film appears thin and glossy on those portions which are dry, whereas the surface of portions which are still wet looks blacker and more dull.

If a negative has to be dried rapidly, it may be simply drained or even blotted off after washing, and immersed in pure methylated spirit for about five minutes, then transferred to a dish of absolute alcohol for an equal time; the dish should always be rocked as the alcohol then extracts the water more rapidly In a fair draught a negative will, after this treatment, dry in ten minutes or less; if it be fanned, the time will of course be shortened.

If the negative is going to be printed in platinotype or carbon, in fact by any process without silver, it is not essential that the film should be protected from contact with the paper, but if it is intended for printing

by any silver process, the neglect of this precaution may lead to stains being produced on the negative. It is needless to say that if a negative requires intensifying, reducing, or retouching, it should not be varnished until these operations have been concluded.

As will be shown later, some of the silver processes for printing are aided by the presence of moisture, and if the moist paper is brought into contact with the gelatine film, it is apt to cause stains from the combination of some of the silver salt with the gelatine of the film. A coating of yarnish of some sort should therefore be applied before printing. A good temporary protection is given by coating the negative with plain collodion.

Although it is quite possible for the amateur to prepare his own varnish, it is in most cases preferable to buy it ready prepared.

To varnish a plate, warm it over a gas-stove or in front of the fire until it feels just too hot to be comfortable when laid on the back of the hand, pass a camel-hair brush over the film to remove any dust, and then, holding the negative level by one corner, if it is small, or balancing it on the outstretched fingers if large, pour a pool of varnish on the middle and cause it to flow over the entire surface by tilting the plate; drain off the excess into a bottle and again hold to the fire in a vertical position, rocking it backwards and forwards to prevent the varnish running streaky. As soon as the varnish has set, the drop left on the corner from which the excess was drained can be got rid of by applying a lighted match to it.

If the negative is damp or not warm enough when the vanish is applied, or left too long after the application of the varnish before being again heated, the

varnish will probably dry with a matt surface instead of being hard and glossy.

The operation of varnishing is one of the most simple that the photographer is called upon to perform, but it requires a certain amount of practice. The plate must never be so tilted that the varnish flows twice over one spot. The plate, being held in the left hand, is best tilted towards the right far corner, causing the varnish to flow towards this corner. As soon as the corner is reached, the plate should be tilted so that the varnish flows to the left hand far corner, thence to the left hand near corner, thence to the right hand near corner, and off into the bottle.

The stock of varnish should never be kept in the bottle from which it is poured on to the plate, nor should the varnish from the plate be returned to the pouring bottle. Our own practice is to pour from the stock bottle into a filter as much as will be required at one time; when this has dripped through the filter into the pouring bottle it will be freed from particles of old varnish, and from any dust or fluff that may have got into it. The dried varnish should previously have been removed from the lip of the pouring bottle; the drainings from the plate go into the stock bottle.

When negatives have to be preserved for use at some future time, it is essential that the hyposulphite should be thoroughly eliminated, and that the negative should be protected by varnish.

For keeping negatives which may frequently be required for use, grooved boxes made of white wood, and having numbers opposite the grooves, form the most convenient receptacles; but where it is required to store them away for any great length of time, they are best laid one on another with a piece of tissue

paper between, then wrapped in good glazed brown paper and put into cardboard boxes similar to those in which plates are supplied. Each box may then be made into a parcel, and a label attached, with either a list of the contents or some reference to a register. It is almost needless to remark that these cardboard boxes should be full, so that the negatives cannot shake about, and that it is convenient to attach a consecutive number to each negative.

The density of the film is so great in the case of gelatine plates, that it is difficult to form a correct estimate of the opacity of the negative until after fixing. It is, therefore, unsafe to intensify or reduce until the negative has been fixed, and although the methods employed in the case of collodion plates can be utilized for gelatine plates, they are unsatisfactory.

The intensification of a gelatine negative is a process which should only be used when absolutely necessary, since no method with which we are at present acquainted is entirely to be depended upon.

The simplest method is the mercury process. A solution is made:—

Bichloride of Mercury	200 grains.
Ammonium Chloride or Potassium Bromide	200 „
Distilled water	10 ounces.

The negative to be intensified is immersed in this solution—*after the whole of the hyposulphite of soda has been washed out*—until it becomes thoroughly white. It is then well washed, and immersed in a dilute solution of ammonia (1 to 50) until the film is blackened through to the back; after again well washing, the negative may be dried. Should the negative have been dried, it should, if to be intensified, be soaked for a few minutes in water.

A better method is, after bleaching in the mercury solution, made with potass. bromide as above, to blacken with silver nitrate solution, prepared by dissolving 100 grs. silver nitrate in ten ounces distilled water, and gradually adding a 20 per cent. solution of potassium cyanide, until the precipitate first formed is almost, but not quite, redissolved. If too much opacity is acquired, reduce with hyposulphite of soda, 20 grs. to the ounce. When, however, great opacity has to be acquired, the most satisfactory method is to bleach the negative in the above mercury solution, and, after washing, develop with ferrous oxalate, to which has been added a trace of hyposulphite of soda. If sufficient density has not been acquired, the process may be repeated. Wash well between each operation. Closely allied with these intensifiers is that supplied by the Platinotype Company, which is a combination of mercury and platinum, and which, as far as our experience at present goes, is to be highly recommended.

Dr. Eder has given an Uranium Intensifier of considerable merit. It requires, however, that the hyposulphite should be entirely eliminated from the film, since the slightest trace will cause a deposit of brown fog on the plate.

Uranium nitrate	30 grains.
Potassium ferricyanide	30 grains.
Distilled water	8 ounces.

This intensifier has one great advantage. It attacks the shadows before the half-tones and high-lights, and can thus be employed in some cases to improve an under-exposed negative, and one solution only being employed, the opacity can be judged with certainty.

It is quite possible to employ an intensifier as also

a reducer locally with the brush, either with or without glycerine, but as we shall have occasion later to speak of brush development, we will reserve what we have to say upon the subject until then.

Should a negative be too dense, it may be reduced by immersion in—

Ferric chloride	2 drachms
Distilled water	8 ounces

for a few minutes, and then, after washing, immersing in the fixing bath.

Eau de Javelle may also be employed; it is prepared by mixing four ounces chloride of lime in sixty ounces of water, and adding eight ounces of carbonate of potash or soda dissolved in twenty ounces of water, boiling and filtering; this solution should be diluted for use. After the application of this solution, the negative is washed, and again fixed in the hyposulphite.

The following solutions may also be employed:—

Potassium ferric oxalate	40 grains.
Sodium hyposulphite solution (1 to 5) .	10 ounces.

Or,—

Saturated solution of potassium ferricyanide	1 ounce.
Hyposulphite solution (1 to 5) . . .	10 ounces.

Or,—

Strong solution of potassium cyanide.

Previous to intensification, the hyposulphite may be removed or destroyed by—

Glacial acetic acid	1 ounce.
Water	4 ounces.
Barium dioxide	1 ounce.

Or,—

Peroxide of hydrogen (twenty vol.) .	2 drachms.
Water	10 ounces.

Or,—

Saturated solution of alum.

The chief defects to which gelatine negatives are subject—apart from those which are inherent to the emulsion, and cannot be cured, when they make their appearance in the plate—are blisters and frilling, pin-holes, green fog, yellow stain, and general fog. Blisters are generally only a preliminary to frilling, and may be prevented by immersing the negative for a few minutes in a saturated solution of alum. If, however, blisters begin to appear before the above precaution has been taken, immerse the plate as quickly as possible in methylated spirit, then rinse well, and use the alum solution. Both blisters and frilling are more frequently met with in hot weather than in cold, and with many brands of plates it is necessary to use ice in the developer when working in a hot climate.

Pin-holes are caused either by air bubbles in the developer or by dust on the plate; either in the camera, preventing the action of the light, or during development, preventing the action of the developer on the film. Plates should always be dusted before they are put in the dark slides, and the slides themselves should be wiped with a clean rag moistened with a trace of glycerine; the plate should again be dusted before development.

Green fog does not often make its appearance unless an alkaline developer be used. It appears pink by transmitted, and green by reflected light, and appears to be caused by the deposition of a minute quantity of silver in an extremely fine state, together with some constituent of the gelatine. It may be got rid of by—

Ferric chloride	100 grains.
Potassium bromide	60 grains.
Water	8 ounces.

After the application of this solution, the negative

is well washed and immersed in the ferrous oxalate developer.

A yellow stain often appears to dim the shadows; when an alkaline developer has been employed it may be removed by:—

Citric acid	2 ounces.
Alum	1 ounce.
Water	10 ounces.

This solution is applied after the hyposulphite has been washed out. The negative must be rapidly washed after its application, since the citric acid tends to cause frilling.

Dilute hydrochloric acid (two drops per ounce) may also be employed for the same purpose.

General fog may be caused by a faulty emulsion, or by the action of light at some stage of the process; it can generally be remedied when in the plate by immersion in a dilute solution of potassium bichromate and potassium bromide. It is frequently caused by the light in the dark room; to test this, put a plate in the dark slide and half draw the shutter. Leave this exposed for a quarter of an hour in the dark-room and then develop. A flaw in the camera is also a fruitful source of fog.

CHAPTER VI.

ORTHOCHROMATIC PHOTOGRAPHY.

WHEN considering the action of light on the sensitive compounds in a previous chapter we pointed out that whilst its yellow components created the greatest effect on the eye, its blue components were the most active in producing the photographic image; it follows, therefore, that a photograph will not give a true monochrome rendering of the subject unless the intensity of the blue or actinic light reflected from the various portions of the subject be proportionate to their monochrome value as judged by the eye. Unfortunately, this is not so, a photograph is therefore untrue.

This fact may be proved with great facility by painting a strip of yellow and a strip of blue side by side, regulating the depth of the two colours in such a way that to the eye they appear to have an equal monochrome value—that is to say, that were a "black and white" artist to render them in monochrome he would make them of equal blackness; a photograph being taken, it will be found that the blue strip will act more strongly than the yellow on the sensitive plate. Again, if a green leaf be turned so that sunlight falls directly upon it, normally to its surface, it will appear to the eye brighter than its neighbour, on which the same sunlight falls obliquely; yet in a photograph the latter

will appear the brighter of the two, since the former will more nearly absorb the whole of the light components except the green (to which the plate is comparatively insensitive), and will scatter less light than the former.

It follows from the above reasoning that to produce an accurate monochrome rendering of a coloured subject requires a plate of which the sensitiveness to the various colours shall be proportional to their intensity. Such a plate has not up to the present been prepared, and we venture to predict never will be prepared. Should this prediction prove false, an almost insurmountable practical difficulty will be met with in that the preparation and development of such a plate will only be possible in darkness.

It has been found that certain organic dyes have the power of rendering the silver salts sensitive to the colours which they themselves absorb; if, then, the predominating colours of the subject be considered, and a plate be rendered sensitive to these colours, a nearer approach to a correct monochrome can be attained.

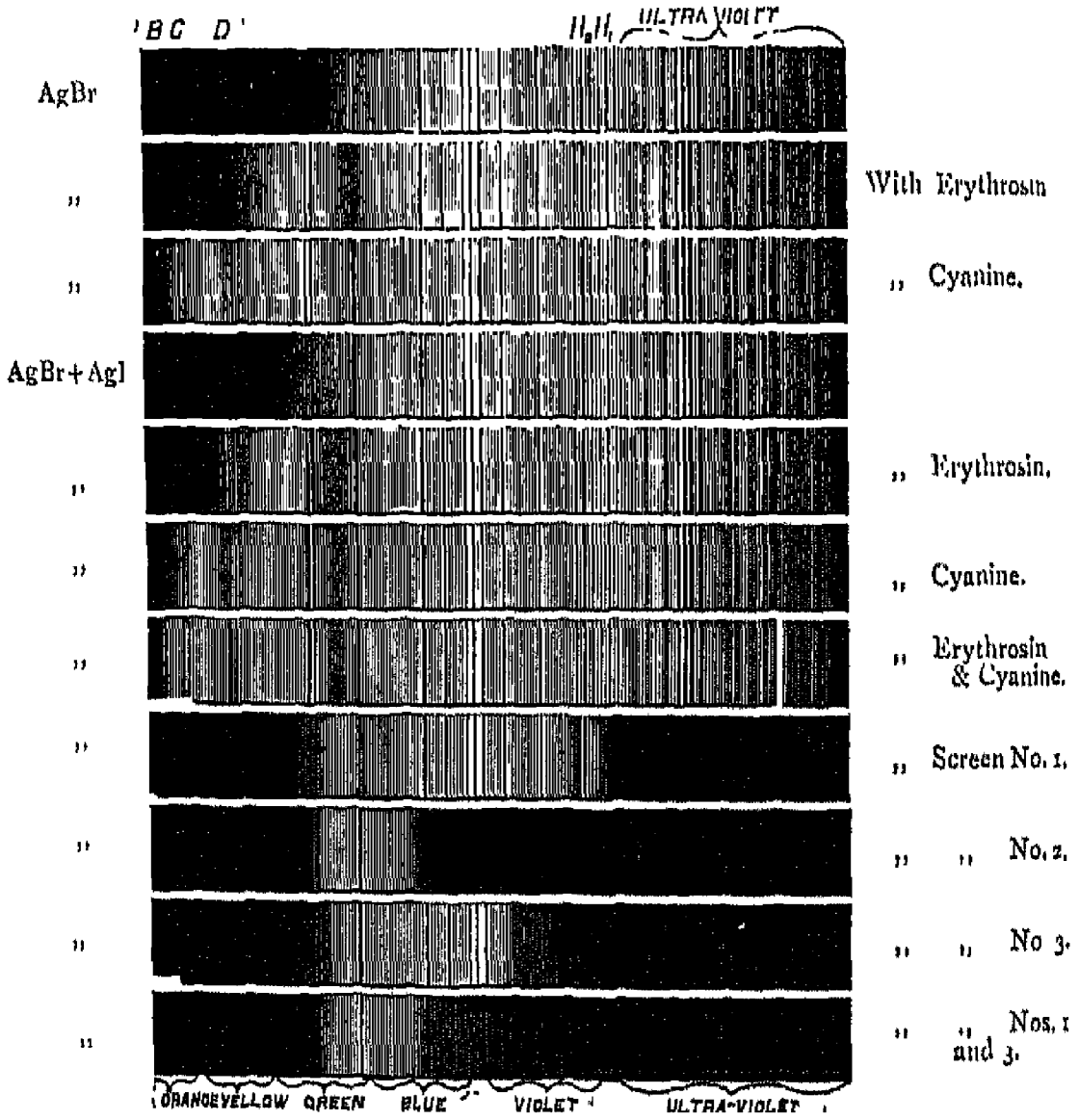
It must be observed, however, that whilst the sensitiveness to various colours may thus be increased, the original sensitiveness is not destroyed, and is so much greater than the colour sensitiveness that the latter would be overpowered were there no means available of reducing the action of the blues.

By interposing a piece of coloured glass between the subject and the lens, or between the lens and the plate, this object may be partially achieved.

In the ordinary summer landscape the predominating colour is green, more or less tempered with yellow; a plate is therefore required which is sensitive to the

greens and yellows as well as to the blues, and the action of the blues must be reduced. A screen of yellow glass will convert the blue of the sky into a more or less pronounced green, to which the plate has been sensitized, so that by the increase of the sensitiveness to green and yellow, and the reduction of the action of the blue, a truer monochrome will be obtained.

These results are very clearly indicated by the spectroscopic photographs which we are able to give through the kindness of J. W. Gifford, Esq.



Drawn on wood from photos.

The ordinary plate is, as has been pointed out, most sensitive to the spectrum about the line G. (midway between the violet and blue); but if this plate is now stained with one of the eosin group of dyes, erythrosin

by preference, the sensitiveness in the region between G and F will be largely increased, and that in the green between E and D will also be increased, but to a lesser degree. Such a plate will render the greens more truly. If it is desired to carry the sensitiveness further towards the red, another dye must be chosen, cyanine for example, which in conjunction with erythrosin will carry the sensitiveness to the yellow through the orange to B or even to A in the red.

The exact action of these fugitive dyes has not been ascertained with certainty; whether they simply decompose under the action of certain portions of the spectrum, and set up mechanically, as it were, a secondary decomposition in the haloid salt, whether they form definite compounds with the silver which are sensitive to light of certain colours, and amenable to development, or whether they combine these two actions, has not been proved. The fact, however, that when the plate has once been immersed in a solution of the dye it may be washed till all visible trace of the dye has disappeared without in any degree impairing its colour sensitiveness, certainly points to the formation of an organic silver compound.

Whatever the explanation, however, the fact remains that they render the plate sensitive to those rays which they absorb.

The reason for the choice of erythrosin rather than any other of the eosin group is that it is one of the least expensive, and is the easiest to obtain in a sufficiently pure state.

Many other dyes may be used; for instance, by the use of malachite green, among others, plates may be sensitized for the reds; but as the difficulty of prepara-

tion and development is so great, as we pointed out earlier in this chapter, we have not considered it advisable to discuss them, especially as such plates are only useful under very exceptional circumstances.

Although orthochromatic plates may be purchased ready prepared, the makers do not as a rule state by what method they are prepared, nor to what colours they are sensitive. The photographer should, therefore, be very careful about their use, as he will have to work to some extent in the dark until he has ascertained for himself their sensitiveness.

It will be found that in very many instances orthochromatic plates are little or no better than ordinary plates, even when the precaution is taken of using a screen; their chief uses are in the reproduction of pictures, water-colour drawings, flowers, sunset effects and landscape in early spring and autumn, or about sunrise and sunset. In ordinary landscape in summer the advantage of orthochromatic plates and the colour-screen lies almost entirely in the reduction of the effect of the bright sky, preventing its over-exposure, and thus tending to preserve the natural clouds.

The selection of suitable colour-screens and dyes for any particular subject can only be made after learning what colours they absorb, either by experiment or by means of the spectroscope.

It is almost needless to remark that colour-screens must be optically worked so that the two sides may be perfectly plane and be parallel to one another, or the image thrown by the lens will be distorted on account of uneven refraction.

The preparation of orthochromatic plates presents

no difficulties, and may be carried out in the following manner :—

Make the following solutions :

Ammonia	2 parts	A
Distilled water	250 „	A
Erythrosin	1 „	B
Distilled water	1000 „	B
Distilled water	200 „	C
Ammonia	4 „	C

Dust any good ordinary plate, and immerse in solution A for a couple of minutes, drain and immerse for one minute in solution C 204 parts, solution B 25 parts ; then wash in distilled water till almost all trace of pink colour disappears.

If cyanine is also to be used, a solution may be prepared by dissolving one part of cyanine in 1000 parts of alcohol, and adding five parts of this solution to the above preparation of erythrosin, thus :—

Solution B	25 parts
Solution C	204 „
Cyanine solution	5 „

Or, better, prepare the plate with erythrosin, then immerse in—

Cyanine	1 part
Alcohol	100 parts
Water	9000 „

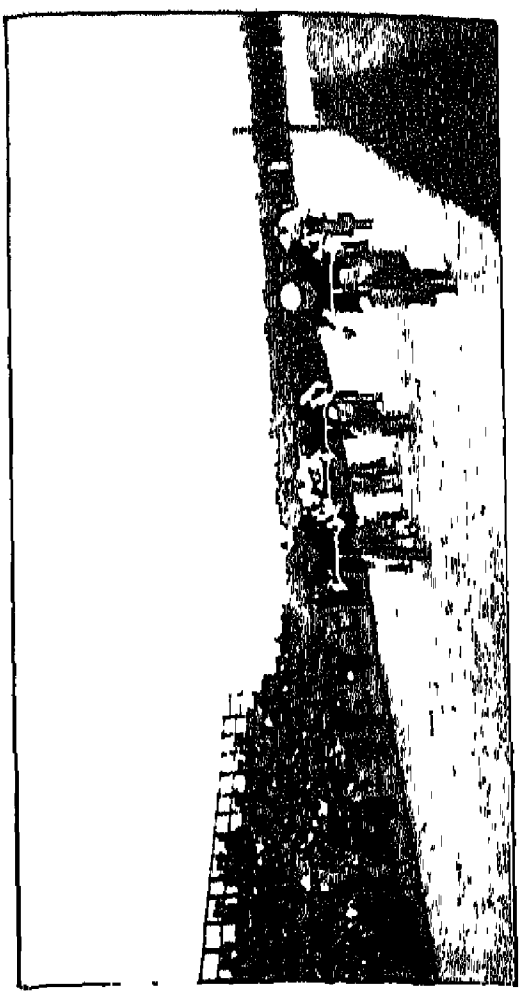
for about two minutes ; wash with distilled water to which 10 per cent. of alcohol or pure methylated spirit has been added, until greasiness disappears, and finally well rinse in distilled water, and either allow to dry or use moist.

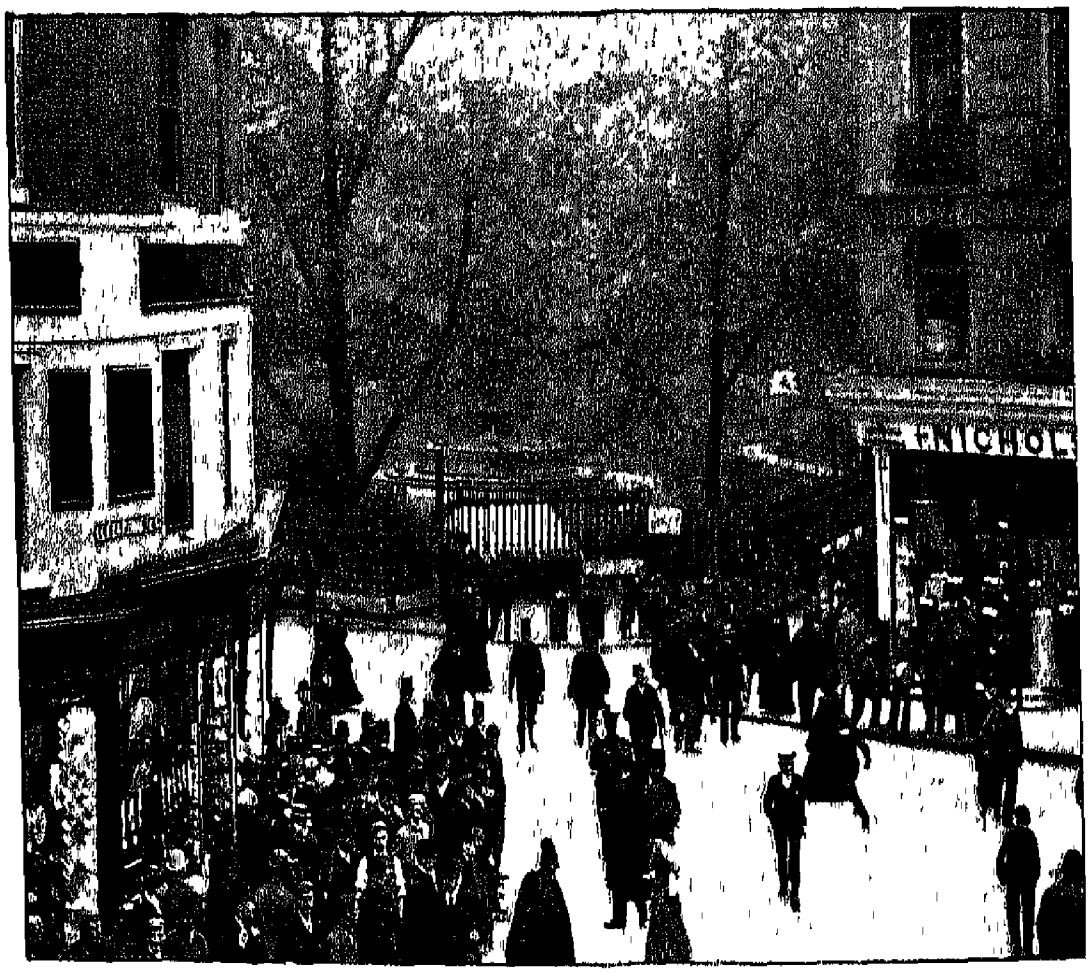
The development of these plates may be carried out by any of the methods previously described, although it

is better to avoid the pyro-ammonia method with orthochromatic plates.

When cyanine has been used in the preparation two or three times the ordinary quantity of bromide should be added to the developer, as the cyanine has a tendency to cause fog, especially if the plate has been dried.

No 1.





No 3. EXPOSURE $\frac{1}{60}$ SEC.

PLATE XIV. [Face page 77.

CHAPTER VII.

INSTANTANEOUS AND SNAPSHOT WORK.

It is rather difficult to decide what should be classed as instantaneous work. We think, however, that a photograph which has received an exposure of, say $\frac{1}{50}$ sec., *in order to avoid over exposing the plate*, should not be considered as instantaneous work, and we propose only to include in our classification photographs of subjects that require an exposure of $\frac{1}{25}$ second or less, *because of the rapidity of movement of the subject.*

Snapshot work is, of necessity, instantaneous; but we shall consider it separately, since it is of a different character. In what we shall call snapshot work, the camera cannot be fixed upon a tripod, and is used rather to photograph a chance object, used without any preliminary notice.

We propose to treat the subject from two points of view; firstly, what is required in instantaneous work; secondly, the apparatus required and methods employed for doing it.

The first point is, to consider what exposure is permissible in various circumstances; and before we can decide this question we must determine what amount of movement of the image on the plate is allowable; that is to say, what is the maximum amount of movement of the image which will not cause it to appear

blurred. This, again, depends upon the size of the image. For instance, if a man were photographed whilst running, and the image on the plate were only a quarter of an inch high, he might appear blurred, whilst another photograph, in which the same amount of movement on the plate had occurred, but on which his image was two inches high, might appear sharp.

We have before us a photograph, taken by Mr. Edgar Pickard, of a batsman in the act of striking a cricket-ball. He appears to be stationary, although the ball appears elongated, the difference in length between a horizontal and vertical diameter of the ball being proportionately great. Had the photograph of the ball been three times as large, and the actual movement of its image on the plate been the same, the proportional difference between the two diameters would have been so small that the ball would have appeared round. The actual movement of the object will of course need to vary in the above cases.

Having noted these qualifications, we may say that in a photograph of half-plate size or smaller, $\frac{1}{100}$ inch is about the maximum amount of movement that can be allowed, and in a whole plate or 12 by 10 photo, probably a $\frac{1}{50}$ inch would be considered sharp.

Let us consider the case of a man six feet high, walking at the rate of four miles per hour. In one second he will move about 50 inches; and if he be crossing the axis of the lens at right angles, his actual movement will be the same as what we may call his apparent movement, that is to say, the distance he appears to move in a direction parallel with the sensitive plate.

If, then, we wish to take a photograph of this man one inch in height, that is, $\frac{1}{72}$ of his real size, and to

allow only $\frac{1}{100}$ inch of movement of the image, we must make a small calculation :—

Actual movement in one second, 50
" " of image on plate, $\frac{50}{72}$
Movement allowed, $\frac{1}{100}$

Now we have the data for a rule of three sum :—

The image moves $\frac{50}{72}$ inch in 1 second
It moves $\frac{1}{100}$ in $\frac{72}{50 \times 100} = 0{\cdot}0144$ seconds
or about $\frac{1}{70}$ of a second.

If, however, the camera were so placed as to point not directly across the line of movement, but at an angle with it, a longer exposure would be possible, since although the man would still actually move at the same speed, he would appear to move across the plate less and less rapidly as the camera was pointed more acutely to his track, until, when right in front of or behind him, he would not appear to move across the plate at all, and we should only have to consider that as he approached the lens his image would grow larger and larger, and would eventually produce confusion both by the loss of outline and by reason of its getting " out of focus."

When the camera is placed as described, but so that the axis of the lens forms an angle of 30° with the direction of movement of the man, it can be shown that his apparent movement in a direction parallel with the plate is only one-half that in the previous case.

Let us now consider another case, which is probably the most rapid work the amateur will care to undertake ; the case of the finish of a horse-race. We are not quite sure of the average rapidity with which a horse moves under such circumstances, but shall

assume what we have heard is approximately correct, namely, that the speed is about forty miles per hour. In exactly similar circumstances as those described in the case of the man walking (that is to say, that the photograph is to be $\frac{1}{12}$ the size of the original subject), the same amount of movement being allowed, we shall require an exposure ten times as rapid as in the last case, that is to say, about one six hundred and sixtieth part of a second.

Calculations similar to those given are very simple, and are of very great service to the amateur, since they indicate clearly the maximum exposure possible under various circumstances.

There is now another point which must be considered, and that is, how much we may cut down our exposure and still have a developable image impressed on the sensitive plate. This must depend on the purpose for which the photograph is required, and on the method employed in development. For scientific purposes generally, for measuring the rapidity of movement of an object, and for similar uses, a ghost of a negative suffices; but for ordinary use something much more is required.

This question is one on which we are not prepared to give a decided opinion, but we think that for most purposes an exposure of one-fourth the correct exposure can, by care in development, be made to yield a fair negative. This would mean that with a rectilinear lens, of aperture *f*/8, an exposure of $\frac{1}{400}$ second could be given at midday in June, when using the most rapid plate on the market on an ordinary landscape subject. For the most rapid work, we need hardly say, a portrait lens working at a large aperture is a necessity.

The first requisite for instantaneous work is an instrument for giving the exposure. The use of the cap is, of course, out of the question for exposures of less than about a quarter of a second.

There are almost innumerable shutters in the market, but only one or two of any real value. In selecting a shutter, there are many points that have to be considered. It must not shake the camera whilst it is open; it must allow as large a percentage of the theoretical amount of light to pass as possible; it must be handy; and it must have some method of regulating the exposure, and of indicating its length. If we take a lens, say three inches in diameter, and we cut a square three inches long on each side out of a piece of cardboard, and pass it at an uniform speed across the lens, we see that we have to move it six inches to open and close the lens, and that, except at the moment when we have moved it one-half the distance, the lens is never properly uncovered. Such a shutter allows only a small proportion of the light to pass, and is bad. An ideal shutter in this respect would be one which would open absolutely instantaneously, and at the conclusion of the exposure shut again instantaneously. We may now say that the most rapid practical exposure with a shutter working on the lens is about $\frac{1}{100}$ of a second, or in large sizes, $\frac{1}{60}$ of a second. It has already been seen that, for many objects, this is not sufficiently rapid.

A shutter has been designed and perfected by the Thornton Pickard Manufacturing Company which works close to the plate. It is of the roller blind type, a slit of greater or less width passing rapidly over the plate. This shutter, known as the "focal plane" shutter, has many advantages. It will work with

any desirable rapidity; it does not cut off any of the light; it prevents the access of any stray light to the plate except at the moment of exposure; and it works without causing any tremor of the camera. The one objection that can be raised to it is that it exposes one part of the plate later than another, and may thus give rise to distortion. Suppose a "focal plane" shutter be used in photographing some object moving at the rate of 40 miles per hour, and having on it a vertical line 10 feet high, the photograph being $\frac{1}{12}$ of the actual size of the object, an exposure of $\frac{1}{1000}$ part of a second is given, but the time elapsing between the exposure of the top and bottom of the plate we will assume to be $\frac{1}{100}$ of a second. Under these circumstances, one end of the vertical line will appear $\frac{10}{100}$ of an inch behind the other; we shall still have a straight line, but inclined at an angle of about $3\frac{1}{3}$ degrees with the vertical. It is only in very exceptional circumstances, however, that an objection can be raised to this, since, if there are no stationary vertical lines in the view, the print may be turned a little in trimming; but even if there are, we must have a certain allowance in extreme cases. It is one of those things which we cannot help. The case we have taken is an extremely unlikely one to happen in practical work.

We show a reproduction of two photographs taken specially for us by Mr. Edgar Pickard with a Thornton Pickard focal plane shutter. The exposure of No. 1, Plate XIV. was $\frac{1}{500}$ sec., and the rapidity of motion of the object about 20 miles per hour; the reduction 20 times; movement of the image on the plate about $\frac{1}{100}$ of an inch.

The exposure of No. 2, Plate XIV. was $\frac{1}{1000}$ sec., and the rapidity of motion of the object about 25 miles per

hour; the reduction 20 times; movement of the image on the plate about $\frac{1}{100}$ of an inch.

One of the difficulties of instantaneous photography is that of getting the exact focus. The ordinary method is to focus for some point which the moving object will pass, then to set the shutter, put in the plate, and draw the slide ready; the exposure is made as the object passes this point.

The drawback to this method is that the object may not be in a favourable position when it passes this exact point. Suppose, for example, that her Majesty is to drive past a certain point, and to obtain a photograph the above method is resorted to, and that at the moment she passes the point focussed she is in the act of bowing, thus hiding her face; the photograph will be of little value.

We are aware of only one method by which this and other similar cases can be met, and that is by the use of a telescope.

From what has been said about lenses, it will be understood that the point behind a lens at which the image of an object situated at any given distance in front will be sharply focussed, depends entirely upon the focus of the lens. It will be easily understood therefore that if a telescope, of which the object-glass has the same focal length as the lens employed in the camera, be attached to the camera front, and an object focussed on the ground-glass of the camera and by the eye-piece of the telescope, the eye-piece being then clamped to the frame which carries the ground-glass, that if the camera be racked in or out, so as to focus another object in the telescope, the same object will be focussed on the ground-glass.

The use of the telescope for this purpose has been

often mooted, but has not, so far as we are aware, been largely employed: for many classes of instantaneous work, however, it is of great value.

In selecting a telescope for this purpose, the only important point to be observed is that its object-glass should be very nearly, if not quite, of the same focus as the photographic lens it is proposed to employ. It is not necessary that it should be achromatic, nor that its defining power should even approach perfection, nor that it should have a large field of view. It should slide easily, and, if possible, its front end should be attached to the camera by a socket which will allow a certain amount of motion, and the attachment of the eye-piece end to the back should be capable of convenient adjustment, in order that it may be arranged to bring an object at any distance, whose image appears in the centre of the ground-glass, into the centre of the field. The chief use of such an arrangement is found in photographing yachts at sea, or other rapidly moving objects, since the camera may be focussed for some object at about the same distance as that at which it is proposed to take the yacht. The telescope being focussed on the same object, and clamped, the dark slide may be inserted, and the shutter drawn; the object to be photographed is now watched through the telescope, which is kept in focus by racking the camera in or out; and the exposure is made at any convenient moment, with absolute certainty that the object will occupy a central position on the plate, and will be sharp.

The conditions obtaining in what we have classed as snap-shot work are somewhat different; since the tripod cannot be used, the camera must be light and convenient to handle. Focussing must be done by means of an engraved scale, since the time requisite to

focus on the ground-glass, substitute a dark slide for it, and draw the slide, would, apart from the practical impossibility of handling two or three things at once, be so great as to preclude the possibility of photographing at all in many cases.

It is in snap-shot work, and in this only, that there is a true field for the hand camera, so much in vogue at the present day. Despite what we have already said on this subject in our introduction, we are strongly of opinion that there is a large field of usefulness for this class of camera; and it is only when it is indiscriminately used for "shooting" anything and everything that comes in the way that we wish our strictures to apply.

For those whose object in taking up the study of photography is simply to be able to carry home records of the scenes through which they pass, and wish to be burdened as little as possible; for those who are not strong enough to carry a larger camera, with tripod, dark slides, and other paraphernalia, on a day's tramp without undue fatigue, and for ladies, the hand camera is undoubtedly of great value.

The main points to be considered in a hand camera are the lens, weight, rapidity of changing a used sensitive surface for a fresh one, the shutter, the level, and the finder.

In small sizes the best lens is undoubtedly what is known as a fixed focus lens, unless the work to be undertaken is very varied, in which case a lens of the rapid rectilinear type fitted in a rack and pinion mount, marked with a clear focussing scale, is to be preferred. As we have already said, when speaking of cameras generally, the weight should be as small as possible compatible with strength. The shutter

should be capable of giving any exposure, from $\frac{1}{100}$ to $\frac{1}{15}$ of a second; should have some arrangement by which it can be set whilst the sensitive plate or film is in position, and should be released either by a pneumatic arrangement or by pressing a button. It should never be released by a pull, since the position of the camera is almost sure in this case to be disturbed. The finder should give as bright an image as possible; and though it is not necessary or advisable even that this image should be the same size as the image in the camera, it should show exactly the same amount of view as will be shown on the plate. The level should not be too delicate, and should be so placed that it can be seen at the same time as the finder.

We must here mention a fault which is common to almost all the hand cameras at present made, namely, the position in which the finder is placed. A photograph should, as we have already stated, be taken, if possible, from a height above the ground equal to the height of the eye, in order that the perspective may not be untrue. The camera must therefore be held high up, the finder and level must be easily seen at the moment of taking the photograph. To satisfy these conditions, the level and finder must be underneath the camera, or on the side, near the bottom. In the hand camera of commerce they are found as a rule on the top, and in order to see them the camera must be lowered at least down to the chest, a position which is both artistically and scientifically bad.

We now come to the last point of importance, the rapidity and convenience of the arrangements for changing the sensitive surface; and with this we may couple the capacity of the camera, that is to say, the number of exposures which can be made without

necessity for access to a dark room. We think that perfection on both these points has very nearly been arrived at by the introduction of films instead of glass plates, their lightness and non-liability to breakage rendering possible mechanism which would have been unsafe with plates. The manufacture of film in long lengths which can be used from the original spool with as little or less trouble than plates, and with equal or even greater facility, permits the maximum number of exposures being made; a point of great importance during a long summer holiday.

In concluding this chapter, we need only say that the rules of composition, and the whole of the manipulations described for tripod cameras, apply with equal force to "snapshots."

CHAPTER VIII.

PORTRAITURE.

If an amateur aspires to high-class portraiture, the only plan will be to have a studio built for the purpose. This studio will differ materially in one noticeable respect from those designed for the use of painters: the source of light in a painter's studio is very much higher and smaller than a photographer is compelled to use. Again, a photographer needs greater length and width.

It is advisable that a photographic studio should face the north, as this light is least variable; strong sunlight is a decided disadvantage in all portrait work.

Some photographic studios are even designed so that all the light they receive is reflected from a plain white wall, no direct light whatever being used. This is only practicable in those countries where the light is very intense and pure. In other countries, as in India and elsewhere, a very small strong source of light, which is transmitted through plain clear glass, is used. This, however, is not possible in England or in any country where so much fog and mist as we experience exists; least of all is it possible near large towns. Moreover, studios built in the centre of towns are frequently hemmed in by the surrounding buildings, so that it is often a matter of very great difficulty to

obtain a proper light unless the studio is built at the top of the house. This is frequently the case in metropolitan studios, but is open to great objection for professional purposes, on account of the inconvenience of ascending a number of flights of stairs. Wherever a professional photographer can get a studio built upon the ground or first floor, it is better policy to do so.

We have stated that the studio should have a greater length than that which a painter needs; this is owing to the necessities of photographic objectives. From 40 to 50 feet is a suitable length for a professional photographic studio, which may be from 20 to 25 feet in width. The side that faces the light should be about 9 feet in height, the opposite side about 13 feet, and from the top of each of these sides the roof may spring to a central point 16 feet above the floor level.

We know of one professional studio, the plan of which is square and 60 feet each way. One side, the side facing the light, rises at an angle of about 70 degrees to a point 30 feet above the floor. This side is covered with movable curtains, arranged in such a manner that perfect opacity may be obtained, or the light may be softened by passing through curtains of thin white calico. The whole of this side is of ground glass, and forms the only light used. This, however, is only possible where a great amount of light is available, and where it is not obstructed by trees or buildings: it is almost needless to remark, such opportunities are very rare in our large towns.

The ordinary shape, such as we before mentioned, is probably the best suited for most purposes. The side facing the north should be of white ground glass, both from the floor to the eaves, and from there to the

ridge. About four feet from either end the roof and sides may be boarded up; the ends will be used for backgrounds.

If the studio be built at the back of the house, on a level with the first floor, the end at which the sitter will be most frequently placed will be that which is nearest to the house, as otherwise the house itself would obstruct most of the light.

The best method of arranging the curtains used for the regulation of the light, is to have piano-pegs driven into the woodwork of the building, and strong copper wire stretched parallel with the length of the building. One end of each wire may be fixed, and the other passed through the hole in the peg, so that the wire may be stretched tight by means of an ordinary tuning key. Upon this copper wire the curtains may be hung, and it is better to have two sets, one opaque, the other plain white.

These curtains, which cover the sides and roof, should be arranged alternately, so that the white ones may be closed up and the opaque ones extended, causing general darkness, or *vice versâ*, the opaque ones may be closed and the white ones extended. Each curtain should be capable of such extension that either the opaque or the white set may be stretched along the whole side of the studio; the whole length of the two sets will, therefore, be twice the length of the studio. It is better that the curtains should not be more than six feet in length when extended. The roof curtains will hang between two wires, and will run upon rings which pass freely over these wires. The curtains which hang vertically on the side of the studio should be arranged in three sets, one above the other, and each set be suspended from one wire. The opposite

side and the opposite portion of the roof may be opaque.

The wall of the opaque side should be painted, in flatted oils, some light colour such as drab or slate grey. The drab should not contain much yellow, as it is difficult to estimate the value of the light this colour reflects. This drab must be cold in tone, and it is very good policy to maintain the colour of the wall in most of the accessories which will be used in the work. Perhaps the best colour will be slaty grey, because all backgrounds that may be purchased will be so coloured.

It is difficult to buy accessory photographic furniture in this colour, but it is very easy when chairs and tables are bought to repaint them. This is probably the best plan, since the decision can be arrived at, the furniture bought from different houses, and be brought to an uniform colour by repainting. The floor may be covered with felt, preferably of the same colour, but somewhat darker than the walls. The reason for having it darker is that it will receive more direct light from the two illuminating portions of the studio, that is to say, the roof and the side facing the north.

There are many methods of fixing backgrounds. Many prefer them upon rollers weighted at the bottom and rolled up when not in use. There is, however, one very great objection to this system. They invariably get creased, and the creases always show, necessitating a large amount of otherwise needless retouching upon the negative.

The best system is to have them stretched upon large frames, the most suitable size of which is 12 × 8 feet. These frames are of wood, fitted with heavy wooden cross-pieces, about two feet in length, at the bottom, which serve as feet, and are furnished with castors

so that the backgrounds can be moved easily to different parts of the studio. The great disadvantage of this system of mounting backgrounds is the large amount of space which they take up; but it must be remembered that backgrounds may be fixed upon each side, so that one frame carries two backgrounds.

A studio would be very well fitted out in this respect for professional purposes if it possessed two interior backgrounds, two landscapes, one plain white, one plain black, one graduated for Rembrandtesque effects, and one having a soft, cloudy effect. It is necessary to use the greatest discrimination in the choice of backgrounds, as it should be borne in mind that one background can properly belong to one picture, and to no other. Therefore, those in which the masses of light and shade are most vague and soft are best for all ordinary purposes. Hard, strong contrasts should be avoided. The interiors may appropriately represent heavy masonry or tapestry, or combinations of these. The exteriors should contain large masses of foliage without any sharp contrasts or strongly defined forms.

If these considerations be observed, photographs may be taken which are not open to severe criticism on the score of inappropriateness.

A common practice amongst some professional photographers of choosing backgrounds which represent palatial vistas, and using them indiscriminately for pictures of ladies in drawing-room dress, gentlemen in sporting rig-out, subjects unmistakably servants, soldiers in uniform, and all the varied mixture of classes who visit a photographic studio, cannot be too strongly condemned. Its absurdity is so extremely obvious that it is almost a wonder that it is ever tolerated, and

probably by the more discriminating portion of the public it is only accepted under protest.

A lady wishes to have her photograph taken, and finds that it is necessary to put up with certain gross incongruities in the pictured representation of herself. Custom has caused the public to overlook these defects, and to accept them as inevitable; but a photographer who aspires to art should never lose sight of the fact that they are not inevitable, that there is no reason whatever why appropriate backgrounds should not be used.

Therefore, we should again insist that the backgrounds used should be broad and soft in character, that the shapes they contain should not have too great definition; in fact, that their whole effect should be to simply relieve the figure, not to introduce any extraneous idea. It will be obvious that the more detail introduced into the background the less will be its actual artistic value, while the work required in its production will be much increased.

Chairs used in portraiture can be purchased from any photographic dealer. Some profess to be adapted to almost any possible pose, but as the necessary adjustments in this case are secured at the expense of solidity of material and workmanship, they soon become rickety, and eventually fall to pieces. The upholstery is also often poor, and therefore of little durability. It is better to decide upon the class of photographs to be produced, at any rate for some time, and buy a few small pieces of good furniture suitable to these effects. When other effects are contemplated it is time enough to add to the list of accessories.

Large, soft cushions, covered with some material with a pattern such as is seen in tapestry, are also

very useful. A few broad-fronded ferns will be found of great service in the composition of pictures, although there is danger in their use, as, if the fronds are largely spiked in outline, very grotesque effects are often inadvertently produced. We have seen the photograph of a lady, taken with a large fern on an occasional table, one of the fronds happening to get behind the head, from which the spikes appeared to radiate like the feather plume of a North American Indian. Of course, this should have been observed before the photograph was taken; but very frequently the fern is introduced at the very last moment. It was evident that the picture needed some additional detail, and the fern was put there to supply it; the cap was removed, and the incongruity and absurdity remained unnoticed until development.

Many photographers adopt a different system of curtaining their studios; instead of having hanging curtains such as we have described, they use spring blinds. This is a bad plan; the blinds are apt to get out of order, and are by no means so easily regulated as in the method previously described. Others use blinds which are stretched upon oblong frames hinged to the roof, and controlled by weighted cords. This system is all very well while they remain in good order, though they are very apt to catch.

A specially constructed studio is within the reach of very few; nor does the amount of portrait work which amateurs as a rule undertake warrant the appropriation of so much space in their homes. Those who have large conservatories attached to their houses can make use of them without any very great difficulty by realizing the essential requisites of a studio, the principal of which is that the source of light be very broad.

It must be possible to reduce this to an almost unlimited extent by the use of curtains, which are so arranged as to be entirely removable when not required.

It should be borne in mind that if a conservatory be used as a photographic studio it must be cleared of all plants. Many amateurs have conservatories capable of being used in this manner, but frequently fail to realize that the only value of a studio is in the possibility of controlling the light. If this light be blocked up with creepers, etc., it would be just as well to use an ordinary drawing-room, where at least an approximation to the necessities of a studio can be sometimes obtained.

At the present day, the public show a marked tendency to insist upon photographs being taken at their own houses. This is sometimes possible, and good results may be obtained; but in the majority of rooms they cannot be realized, because not one person in a hundred has a room possessing any of the qualifications of a photographic studio. To begin with, the windows are too small, and there is no top light; the sitter must be posed with the fireplace, or some similar portion of the room, as a background, or huge accessories must be introduced which are too large to be handled with facility, and are of little use.

It should be borne in mind that a photographic background owes the depth of its tone to the angle at which it is placed to the light. If a background in a studio be inclined towards the light, it will become very much higher in tone; if, on the contrary, it be turned from the illuminating area, it will become deep and sombre, and all shape on it will be lost. It is manifest that these regulations of the tone are not

possible in an ordinary room, therefore, if we wish to indulge in "Photography at Home," we must bear in mind that only some few effects can be produced. A large amount of reflected light must be used; and when it is remembered that a background, a huge reflector, and camera and stand must be brought into an ordinary drawing-room, it will be seen that this will be attended with a considerable amount of inconvenience.

Such work should be confined to photographing very few subjects, such as invalids who cannot be removed, and are, perforce, obliged to spend their days in an armchair. In such cases it is probably better to attempt only the head. If, however, a sitter is obliged to lean, and the chair thus becomes an essential part of the picture, as little accessory furniture as possible should be introduced.

Many people insist that their pet—a favourite cat, dog, or bird—be photographed with them. This is absolutely impossible in a house, as the only way in which such subjects can be attempted must be in a very broad, strong light, and even then the results can only be regarded as diagrams, not as forming any part of a work of art. We are all familiar with the photograph of a cat asleep upon a cushion. The outline of the animal is rarely beautiful in this position. A dog, if he be not exceptionally lively, will generally lie down in a room, almost invariably choosing the floor, so that he can only form part of the picture when the floor is very much in evidence. This is difficult to secure unless a short focus lens be used whose aperture is limited by optical considerations, and which is therefore slow. Such an objective is manifestly unsuitable for indoor portraiture where living creatures

form part of the picture, and which is, therefore, so far as possible, to be avoided. Animals should never be attempted in a room, or plates will be wasted.

A few lightings, Rembrandtesque in character, may be attempted in drawing-room portraits. It is needless to remark that the face must be turned to the light, and a reflector must be used. Another objection to photographs taken in an ordinary room is that the decorations of the room are rarely if ever suitable, but are almost invariably too dark.

If it is desired to photograph at a sitter's own house, the best plan is to use the garden; and in this case it should be borne in mind that a head, like any other object, becomes prominent in a picture, from the fact of its strong contrasts of light and shade.

If the back of the house is flat, and faces the south, it is impossible, when there is any sunshine, to take a photograph that shall be artistic and pleasing. When a sitter is turned towards the sun, the invariable result is a screwing up of the eyes, which gives a sufficiently unnatural aspect to the face, or if not unnatural, at least very unpleasing. Very few people can bear a very strong light upon the eyes, but even if they are capable of this feat, to subject our sitters to a quarter of an hour's torture every time we want to bring our camera out, is not the way to make them pleasant.

When a house faces the south, to obtain the best results there should be some portion projecting beyond the main part of the building, so as to form a corner. If this corner be on the east side of the garden, the morning will be the best time of the day to photograph; if, on the contrary, it be on the other side, the after-

noon will be best, because then, at each of these times, we shall have a shady spot.

The sitter may be posed in this corner with the back to the main building of the house; and the nearer the sitter is to the projecting building, the deeper will be the shadow on that side of the face which is towards this projection.

It is generally possible to get rid of the top light by hanging up something, such as a large tablecloth, extending from the projecting portion of the building to some support in front of it. This may be temporarily fastened up with a few nails driven into the wall, and suspended by cords fastened to these nails. The reason for this curtain is, that if a great amount of top light be used we shall get very black shadows under the nose and chin, all the rest of the face being flat, unless it be turned somewhat towards the projecting building.

If the projecting portion of the house be white, its usefulness will be considerably diminished, as it will reflect too much light; and in portraiture which is attempted out of doors, as well as that which is done in a studio, the same rule obtains; there must be one primary source of light; there may be a secondary or reflected light, but it is not always necessary.

Photographs taken in a garden have the open sky for the source of the primary light, and in such cases it is seldom necessary to use a reflector, the difficulty being not so much to increase the light as to reduce it. Many excellent portrait photographers prefer the lighting which is possible in a garden, because of the noticeable absence of deep black shadows. And there is much to be said in favour of this idea, as portraits which are taken under such circumstances are fre-

quently very much softer in effect than the majority of studio productions.

It frequently happens that a professional photographer, about to commence business, decides that a certain house in such and such a street would be a good position for his business; unfortunately, however, the back of the premises is hemmed in with buildings, so that he is unable to build a studio at a reasonable distance from the ground, except one lighted wholly from the top. Many photographers are under the impression that this difficulty is removed by increasing the area of the ground-glass side or sides of the studio. The advantage of doing so is very slight indeed; it does not remove the difficulty. It should be borne in mind that light always proceeds in straight lines, and an imaginary line drawn from the top of any one of the buildings with which the studio is surrounded to the floor will indicate the lowest available light in that direction. Many operators, compelled to work with this inconvenience, endeavour to overcome it by invariably using a Rembrandtesque lighting on the heads they photograph. In some instances this is suitable; but it is terribly monotonous, and cannot be in good taste for, or well adapted to, all subjects.

Amateurs should be especially warned against attempting pictures with full-length figures which purport to illustrate certain historical or other incidents, unless the accessories are very carefully chosen. For instance, we are all acquainted with the photograph of a little boy in a sailor's dress, standing upon a piece of wood nailed across another vertical piece, a few ropes hanging down, and the whole arrangement manifestly standing upon the floor of a studio. The face of the child is lighted only on one side, the other being in

deep shadow. Such a lighting rarely happens when a sailor is standing on the cross-trees. The arrangement which pretends to represent a mast-head, generally bears about the same resemblance to the real thing as does the drawing of a man executed by a savage with a sharp flint upon a piece of bark, to the human form. Any combination where the figure is so very much like a child, and the accessories so very little like what they are intended to represent, must be incongruous.

Hundreds of instances of this form of absurdity might be quoted: there is the photograph of a child in a similar dress standing upon the floor of a studio, a dried star-fish lying upon the boards at his feet Behind him hangs a background; the boy, perhaps, holds a toy boat in his hand. He has been photographed from a point of sight about four feet from the floor, but the background has been painted with the point of sight about twenty feet high. Moreover the figure is lighted so that a strong shadow is thrown upon a representation of the sea in the background, and practically obscures a large three-masted ship which is about two miles away. Such a combination of curious events is, to say the least of it, improbable.

Then there is the young lady sitting in a boat and holding an oar in her hands. The boat is a peculiar one, the whole of one side can be seen, also the bows, and a very large portion of the other side. It is perhaps superfluous to say that such photographs are in bad taste; but they are so common, and the opportunities for buying such accessories are so great, that there is an almost universal tendency amongst amateurs to fall into these absurdities. The photographs of the child are sufficiently bad, but they are not so offensive as that of the lady. Any arrangement

which tends to make either a man or a woman look ridiculous by reason of its absurdity, should be condemned. The child could be just as well photographed with a perfectly plain background, or with one that is slightly clouded; there could be no objection to his holding a toy boat or a spade or pail; such a picture need not aspire to any very great variety in pose, and the melodramatic character of the mast could very well be dispensed with.

Another instance of bad taste is very common. The amateur is the most frequent sinner in this direction. This consists of photographing people in the costumes of different nations. A lady amateur has been on a Continental trip, and has brought back with her several peasant head-dresses, characteristic of the different countries she has visited. These are used indiscriminately to decorate her lady friends, and we are asked to admire pictures of ladies with fair Anglo-Saxon features wearing the rows of coins upon the forehead that are worn by Albanian peasants. Or else it is a face with dark aquiline features, black eyes and hair, surmounted by the huge white head-dress which is worn by the peasantry in the Bergen district of Norway. Such combinations are never beautiful, because they are untruthful; they do not resemble the real fact at all. A lady with fair hair, a short, broad face, a strong decided mouth, and the animated and intelligent expression of the Anglo-Saxon race, must look inappropriately attired if she is wearing a costume which belongs to her direct opposite.

The Eastern type of face, Greek, Turkish, Syrian or Arabian, is very marked, and the head-dress of either of these races is as much an expression of the national character and necessities as a Tam o' Shanter cap.

In England a man would not wear a tall silk hat, and ride a bicycle at one and the same time. A lady would not wear a hat that was manifestly ugly and unsuitable, and it is very difficult to see what is found admirable in photographs of one's friends in which the costumes are inappropriate.

Let the amateur endeavour to illustrate some character drawn by one of our poets, but let judgment and discrimination be exercised first in the choice of the model. A Turkish or Albanian head-dress, clapped on any young lady's head, will not make a Zuleika, nor will a skull-cap, a yellow *jelick*, a cestus and shawl be sufficient to convey an idea of Haidée. We are all acquainted with the portrait of the City gentleman who has been to a fancy ball, and has afterwards had his photograph taken. He happens to weigh sixteen stone, so he goes as Henry the Eighth, and a very comfortable, amiable and benevolent version of that uxorious monarch he looks. He is somewhat weak in English history, but he can remember that the last Henry was a stout man, and wishing to present as kingly an appearance as possible, he decides upon that character. Mr. Tupman as a bandit could not look more comical than some of the costume photographs we see in our friends' albums. There are hundreds of subjects that could be chosen for character photographs, simple and easy. The works of Shakespeare, Byron, Moore, Tennyson, and many others, are inexhaustible mines of subjects for illustration, and it will be found much better practice to endeavour to give the subject the necessary character, without depending so very much upon the costume.

A head can be so posed and lighted, that with a very simple draping effectively arranged about the shoulders

enough is indicated without the picture depending on the microscopic fidelity of the costume. Such a character as Ophelia, for example, may be represented by a photograph without the subject having her hands full of all the different herbs and flowers that Ophelia distributed among her friends. Endeavour that the character be indicated by the type of the model, the pose and lighting of the head, the expression of the face, &c., and then if it is possible to obtain an absolutely accurate costume, all the better; but to simply photograph a lady in a Spanish costume, for example, and call it "Preciosa," is about as intelligent an operation as to take a technically perfect negative of some commonplace subject without any pretence at arrangement, and then call it a work of art.

CHAPTER IX.

LIGHTING AND POSING.

BEFORE commencing to light a head let there be a clear understanding as to the object of the composition. There should be a distinct purpose in the lighting, which should be so arranged that whatever is considered most valuable should be emphasized, and other parts, less important, subdued.

Let us consider a head which has a good clean outline, firm chin, straight nose, &c., but which has too great a breadth across the jaws, and what often accompanies such a head, a large but well-shaped mouth. Now it is certain that if we can so arrange the subject that the lighting shall minimize the width of the face, but shall leave the profile distinct and vigorous, we shall obtain a portrait which will be better from an artistic point of view than if the conditions were reversed.

Let us assume that the subject is posed showing the face in profile. There are several lights which may be thrown upon it. The best one will be from a point somewhat in front of the face, but not between the camera and the sitter; rather the other side of the head, so that we get a strong line of light on the edge of the forehead, nose, mouth, chin and neck, and all the rest of the face and head in half-tone. If we only use one

No. 2.

No. 1.

PLATE XVI. Face page 104.

light, the contrast would be very great, and the picture would be too hard; but if we bring the reflector up near the head, we shall obtain a secondary light on the shaded part, soft and broad, the effect of which will be to reduce the contrast, leaving the outline as clear as before; and as the contrast of the whole is reduced so will be the contrast of each part. The broad jaws will not appear so marked; the whole of the head will have less width.

We will assume that the background is deep in tone. Now let us consider what would be the effect if the lighting were reversed, and the primary light came from some point between the camera and the sitter: the most prominent parts of the head would naturally receive the strongest light; these would be the ear, the jaw, the cheek-bone, etc.; the nose, forehead, chin, and neck would recede into the background, and we should have a very vigorous view of the worst parts of the subject. Manifestly this would be a badly lighted head.

We are using for illustration Plate XVI. Nos. 1 and 2, two views of the same head, taken within a few minutes of one another. The profile is the kind of lighting we first mentioned; the full face turned directly to the camera is an instance of an unsuitable lighting, and was introduced to show what sort of face the profile would appear if differently posed.

Attention should also be paid to another point: A very great deal may be done for or against the success of a picture by the greater or less realization of the value of contrast. When the head was posed in profile, a very dark background was chosen, in order that the line of light in front might appear very vigorous. If the pose and lighting had remained the same, and

a white background had been substituted, a very unpleasant effect would have been the result. The hair, which in the subject chosen is very fair, would have appeared dark. When we say the hair was fair, we do not mean that it was reddish or yellowish, but simply very light. It would have appeared dark by reason that the shadows on it would have been darker than the background; the same might be said of the whole of the face, but there the defect would have been evident. The outline of the forehead, nose, chin, and throat would have been lost.

This is considering the subject with two possibilities, which do not often happen together; one being that the light or the sitter may be moved, and the other that the background may be changed. When this is the case there is little or no excuse for lighting badly.

Plate XVII. Nos. 1 and 2 were chosen to illustrate the value of the background; the posing and lighting of the head has in this case no very marked characteristics, it is in fact one very frequently seen. No. 1 is a reproduction from the original negative, whilst in No. 2 the background has been "blocked-out" during the process of making the block. This has been done in order that the influence of a lighter or darker background should thus be clearly apparent.

Plate XVIII. No. 1 is another head of the same subject, taken a few months previous; we arranged a similar head, as far as posing and lighting was concerned, the same day as the profiles, but the negative had a defect in the film, and so could not be used for reproduction; but it is the same head, and is chosen to illustrate a very good and useful lighting. The subject has a somewhat high, but not a very broad forehead, while the cheeks are very depressed. The object

of this pose and lighting was to bring out what good points there were in the forehead, and even to increase them, and to fill up the hollows under the eyes: to this end the subject has been posed almost full-face, and has had the light falling from a point which is slightly at one side, and rather low; it is thrown across the face, so that it indicates the full size of the forehead, and brings it well in evidence, while it is not high enough to throw a deep shadow from the brows under the eyes, but rather causes the cheeks to appear more prominent. And here we would like to draw attention to a very common error: this lighting and slight modifications of it are very often used in portraiture, and when carefully arranged, very good effects may be produced; but if the negative be put into the hands of a man who retouches for the trade, in ninety-nine cases out of every hundred he spoils it. In this position it will be observed that the high light on the nose is on its right-hand side, where it should be; but if the head were turned a very little more to the source of light, the high light on the nose and on all other parts of the face would be on the left-hand side. Retouchers are frequently unable to realize this fact; it seems to be part of their creed that if a face be turned to the light the high lights will be on the side nearest the light, whichever side of the face is towards the camera; this, of course, is absurd. A head is not a sphere, and a forehead is nearly always slightly flattened in front; so is a nose; a chin is often actually depressed in the centre.

Let the student get a good cast of some head from the antique, and make a few experiments in lighting. The cast can be put upon a table lighted by a lamp or a gas burner, thus using a single flame only. The cast

will not move, the light will remain constant; and what is true of a cast and the flame of a lamp is just as true of a living head and the light of the sun.

It would be a good plan if photographers, when sending out negatives to trade retouchers, were to insist that the high lights were not interfered with; it rarely happens that a retoucher is competent to alter them without spoiling the head, because if he could draw he would not confine himself to retouching for the trade, and if he cannot draw he has no business to meddle with the outline of a face in any way.

Plate XVIII. No. 2 is a type of lighting suitable for a head without any very strongly marked characteristic; the features small and clean in shape, the face has no great depth inwards from the brows, so this lighting, which has a tendency to bring the nose forward, may be used. It should be observed that in this particular lighting there are two distinct means of determining the width of the nose: one is by the outline it makes against the shaded side of the face, and the other is by reason of the line of light down it on the far side. In this connection we will draw attention to an important fact.

When a studio is built for an artist to paint in, the window is frequently a long one, with the lowest part of it several feet from the floor; that is, at least, the most common position of the light in a painter's studio. A painter may use much stronger contrasts of light and shade than a photographer, because he has the immense advantage of colour. The latter has to deal with a broader light, much lower down, or he would get intensely black shadows on the eyes, nose, and chin in all his studio compositions. Now it is well known that the farther away we get from a

No. 2.

No. 1.

PLATE XVII. [Face page 108.

window the weaker will be the light, but it will be more spread and diffused; consequently, if we wish to light a head with sharp and thin features and hollow markings under the eyes, we shall do well to use a broad soft diffused light low down, and in such a case we shall need very little reflection. But if, on the contrary, we wish to sharpen and strengthen a face, we can do this by bringing the subject near to a smaller but brighter light; this will be reflected from the prominent parts of the face; the high lights will be clear and distinct; but it will be necessary to use a lot of reflected light, otherwise we should get too much contrast. When photography with the electric light was first attempted, the great difficulty was found in the strong contrasts; the light was small but intensely bright, and the head lighted with it became too "black and white." Many plans were adopted to correct this defect, but the best was to interpose a disc of white porcelain between the light and the sitter, and on the other side have a large white parabolic reflector. This plan worked well; the sitter was lighted wholly by reflected light, which was found to be quite strong enough. So we may decide that if we wish for brilliancy in lighting we must bring the sitter near to a strong small light; if we wish for softness, the light must be more diffused, and weaker.

Plate XIX. No. 1 is taken as an example of lighting suitable to a face which is broad and has no great depth of feature, and where a profile view is inadmissible. The attention is here attracted by the patch of light down one side of the face, hair, and neck, so that we have a comparatively long light on a face which in ordinary lighting would look short. The contrast between the lighter side and the half-tone is not great,

and the background is also medium in depth, so that there is nothing to interfere with the effect of the patch of light, which is the longest possible on such a face.

No. 2 on the same plate is another example of the same head somewhat differently posed, showing how a little variation from the best is at once apparent. In this instance the face is turned too full to the camera, so that we do not get the advantage of the lighting.

There is naturally a great variety of poses and lightings possible in photographing a simple head and shoulders. We have prepared our illustrations with a view to pointing out some of the advantages and defects of certain arrangements, and, as in our chapter on Composition of Landscape, we would again remind our readers of the fact that a photograph is a picture in monochrome: that a head may look very well when posed in the studio; its inverted image upon the focussing screen may seem to promise a good result, and yet, somehow, we are disappointed. The reason is in nearly every case that the colour of the living model is wanting; very few faces, also, will bear the strict examination such as we give to a photograph. When the sitter has gone, and the negative is developed and printed, the interest of the earlier stages of the work is diminished, and we can see faults that remained unnoticed at the time of the sitting.

It is absolutely necessary that we pose and light with an intelligent purpose. This is an age in which the public are made acquainted with the faces of celebrities to a degree that could never have been attained in any previous century. Those who are not engaged in such work as photography of noted men and women have little idea of the thought, study, and labour entailed, or of the number of sittings that are necessary before one

simple cabinet head is produced and accepted. It is no exaggeration to say that certain of our leading portrait photographers have taken thousands of different negatives of some sitters: it is no uncommon incident for a lady, perhaps a leader of fashion, a noted actress or what not, to come to a studio several times in one year, and at each sitting from twenty to thirty negatives are developed, retouched and printed. Out of this large number perhaps three at each sitting will be chosen. It is within our knowledge that an enthusiastic amateur of really artistic ability will frequently spend as much as fifty pounds in the production of one picture before he considers he has produced a satisfactory result, and he has had the advantage of many years' experience and the best models. This is the true spirit in which to commence any work of taste.

The professional photographer is compelled by competition, and by the increasing demand for the best work only, to expend sums of money which even very wealthy amateurs would be astonished at. Certainly he hopes to have it returned with large interest; but none know better than he that expense, time, money and labour are inevitable, and if the amateur hopes to bring his work into competition with the professional he must expect to work as hard, or even harder, because he has not had the advantage of incessant practice.

We have heard second-class professional photographers ask the question, "Where does Mr. So and So get his models?" just as if there existed an emporium where one could go and make a selection. This is the idea of the man who does not like exertion, or who is incapable of distinguishing bad from good,

the ugly from the beautiful; and, as we stated before, this incapacity is greatly owing to the fact that although a face in actual life may look very pleasing, it is in nine cases out of ten owing to its colour.

Many faces are pleasing on account of the animation they display, but they will not photograph well, or they will only look really well in one position and lighting. Yet this cannot be repeated *ad infinitum*, as it soon gets monotonous. For example, we have to photograph a lady with a delicate pink and white complexion, eyes inclining to blue, and fair hair with a tinge of red in it. If such a face be turned to the light the eyes will be absolutely lost, they will come out white in the print, while the hair will be very much darker than it appears in nature. This will manifestly not produce a good likeness, however accurate the exposure and development may be. Those faces that are best for photography are the ones that have least decided colour in them—dark hair, sallow complexions, dark eyes, faces of an Eastern type, in fact, those that look in life nearest to a monochrome study; there is less change when they are photographed. The orthodox English and German type is most difficult to represent, and it is in such cases that the value of contrast is most apparent. A very fair lady with blue eyes may, if she possess a good profile, be posed so as to display it; the light may fall from a point between the plane of the sitter and that of the camera, and striking the back of the head. The face will then be in comparative shadow; the hair will be very light, and the eyes, being turned from the light, will not have the "fishy" look which they would have if the light fell directly upon them. If a background be used which is deeper in tone than the shadows of the head and face, the general effect

No. 2.

No. 1

PLATE XVIII. [Face page 112.

will be tolerably truthful; but if the position of the head be reversed, it will fail utterly.

We are all acquainted with the portraits we see on the beach at a seaside resort---the black faces are the most distinguishing characteristics. It is very easy to look sadly upon these productions, and to pass by on the other side, but really in most cases they are the only results possible to the voluble gentleman who is responsible for them. In most cases the sitters have had very red or even dark brown faces, the actinic value of such colour is, as we have said, very little; darkness is the inevitable result. We do not attempt to defend such work, it is quite indefensible on any ground other than that of sheer poverty or dense ignorance, and ignorance of a law is no excuse for its flagrant violation.

An excellent lighting of a female face may be attained thus: let the source of light be broad and high, place the sitter with her back to it so that the face is in complete shadow, bring a concave reflector close up to the head so that the face receives only reflected light. We have alluded to this particular lighting in another place, and mentioned the use of a concave reflector. We are under the impression that this instrument is little known even amongst professionals; but some few of the best do use it. It consists of an oblong frame of wood standing upon a simple support; it is capable of being lowered or raised as the occasion requires. The frame is about four feet by three in size, and on each of its sides a plain board painted a dead white with distemper, or covered with white cartridge paper, is hinged. These boards may be about eighteen inches in width, and so arranged that they cannot be brought to right angles with the frame.

This is interposed between the camera and the sitter. Each of these wings forms a separate reflector, which can be used very much nearer to the face than the ordinary one in use in the studio. If the four sides be brought together as nearly as they will come, it has the shape of a truncated pyramid with an oblong base, the base being parallel with the plane of the picture; the photograph is taken through the space between the four wings. It is only suitable for heads, because the size of the frame limits the picture, but its value for such work is very great. It may be made to run on castors so that it is easily moved about; the wings can be arranged so that they will fall when not in use, so that it does not take up a great deal of room.

When the sitter has been posed, or approximately posed, the curtains which regulate the light are next adjusted, the reflector is brought up, and the operator may stand in front of his model, holding the long rod with which he moves the curtains, so that he need not leave that spot until the picture is arranged.

If a head be posed with a light falling from a very high point in front, an effect is produced which is not always desirable, the forehead appears very marked and prominent, the eyes are surrounded by a deep shadow, giving them a sunken appearance, the upper jaw becomes too prominent, the chin, unless it is very strong, naturally recedes, and the whole of the face appears older than it would in a more suitable lighting.

If an old man is being photographed simply as a study such a lighting may be used, although there seems little necessity for it; but if a portrait is required it will not be found suitable—there is a prejudice against looking much older than we really are, even amongst the most philosophical. A lighting can be

No. 2.

No. 1.

PLATE XIX. [Face page 114.

made to increase or reduce the apparent age in a very marked degree. In determining the character of a picture there are two considerations possible. Whether it shall have as much force and vigour as possible, or whether the contrast shall be small and the picture depend for its beauty upon its softness, both can not be attained. We must decide how much of each shall give the distinguishing character. It is not considered necessary to enumerate instances of lighting the full length figure or group, because the simple head and face contains material for study for a very long time, and when the amateur has overcome the difficulties he will find in that work, he will have got so far on his way that he will need no further help; he will have arrived at conclusions of his own which will enable him in every case to decide for himself.

It is not within the province of this book to enumerate all the different lightings possible. Their name is legion, and even if space permitted, it would serve no good purpose, because to slavishly imitate is a bad system.

Each will naturally form his own set of ideas, and that which he is so will they be. To attempt to bend one's mind in exactly the same direction as another's is to court failure. We would rather suggest a few of the leading considerations, and leave the reader to decide how much he will retain, how much reject, and what use he will make of that which is retained. People very often read a technical book simply to find corroboration of their own opinions. If the book does this it is good, and if not, they say that it is bad; and photography is crammed with untried and untested theories.

CHAPTER X.

RETOUCHING.

On the subject of retouching photographic negatives, there are a great many conflicting opinions, and a great deal of nonsense has been uttered both for and against this operation; some perfectly competent photographers urging that a photograph is quite incomplete until it has been retouched, others asserting that when a negative leaves the dark room it is quite ready for the printer; that it is bad taste, bad art, and, in fact, a very objectionable thing to interfere with it in any way. Celebrated photographers of the human figure have endeavoured to demonstrate by their work that retouching a portrait is only another name for spoiling it; that it is possible to take a photograph in such a manner, posing and lighting artistically, using a suitable lens, and so making use of the mechanical means at their command, that when the photograph is finished it is almost perfect.

Retouchers have only themselves to thank for this attitude taken against them. Some retouching is detestable; it is senseless and purposeless, and cannot be too much condemned. But as there are artists and Artists, photographers and Photographers, so there are retouchers and Retouchers; and we may assume that if the object of retouching be legitimate, and if it be

Untouched.

PLATE XX.] [Face page 116.

carried out in a discreet and intelligent manner, the result should justify the process. It is most probable that any very sweeping condemnation is inaccurate, so, on the other hand, blind partisanship of any process or theory is likely to lead us astray.

It is not so very long ago that photography itself was condemned in a most wholesale manner. A photograph, it was said, could not be a work of art at all; it was purely mechanical, and had no claim to be considered as artistic. The photographer was understood to be a somewhat dirty individual, arrayed in a velvet coat and a slouch hat, whose fingers were generally black with nitrate of silver. We have been nauseated with the silly discussions that have been held about his claim to be considered as an artist. We have lived through this—"the old order changeth, giving place to the new"—and the intelligent painter has recognized that photography, while it cannot rival, can teach him, and that while he cannot by his sneers injure an art which has its base in truth, that very art may draw attention to his own shortcomings. He is fortunate if he be the first to notice and correct them. This is all passed, and painters, sculptors, in fact, artists of almost every type, have admitted that certain photographs have fully justified their claim to be considered "works of art." This is as it should be. It is a narrow and bigoted perception that can only see one side of a subject, and we think that if we keep our minds open on the subject of "retouching" a photograph, we shall conclude that it is not only justifiable, but necessary, on artistic grounds.

First of all, let us understand what we mean by "retouching." To some it means stippling and hatching; taking a dozen negatives and applying exactly the

same operation to each, making the faces dead smooth, sharpening and strengthening all the lights, and so interfering with the face that all likeness is destroyed.

Others, who are more ambitious, go a step further. They are not content with this; they like to see the result and the process at one and the same time, so they handle the negative in such a manner that every touch they put on can be distinguished when it is printed. This they call obtaining "texture;" and they lay down a rigid code of rules as to how the pencil should be handled, and what character of a mark it should make to obtain this result.

Again, others appear impressed with the idea that it is not possible to take a photograph that is sufficiently vigorous, so they relieve the operator in this matter by indiscriminately strengthening all negatives that come under their hands.

Then, again, there is the landscape photographer, who appears to think that the sky is always full of clouds, that all clouds are white, and that if a landscape photograph does not give this effect it is incomplete, and that it is the retoucher's duty to remedy it.

We do not associate ourselves with any of these. We would like to prove that there is a certain class of retouching which is necessary. We are quite indifferent as to how it may be received by those who think that retouching is always a mistake, and we are not sanguine enough to expect or hope that they will reverse their opinions at a moment's notice; because the facts that induced those opinions will always remain, and they will look at those facts through the medium of their own capacity.

First of all, there can be no doubt that art consists of the selection of the best. A man is not an artist

simply because he draws and paints; the workman who covers the fronts of our houses does that, but being modest, does not think himself an artist. A landscape artist very often spends weeks before he can decide upon the proper view to take of a certain landscape; and this power of selection is the quality which every artist exercises a life-long study in developing; without it there can be no art. It is not enough that one should be able to reproduce, either with brush or camera, a comparatively faithful representation; if this were the case, the photographer would of necessity be a greater artist than the painter. It is simply the capacity for the selection of the beautiful as distinct from the ugly that constitutes the claim.

If we are on the pavement of the street and we see a friend approaching, we are able, when he is a very long way off, to recognize him, even when he is so far away that we could not feel sure whether or not he was wearing a collar and necktie. We decide upon his identity by reason of a few broad facts. It is about the time of day that we are accustomed to see him; he walks on that side of the road that he particularly affects; we remember the way he carries himself. As he comes nearer we see other details which we remember; the shape of the face, his colour, his hair, perhaps his clothes, although they, of course, vary. He may now stop, and we may engage in conversation for a quarter of an hour and then part; and if we were asked what was the colour of his eyes, the chances are we should have to admit that we did not know. Let any man who is not in the habit of observing faces try and describe accurately, from memory, the features of his most intimate friend. He will find that he knows very little about it, and yet he knows the

man. We do not recognize our friends by remembering exactly all their little peculiarities of feature.

We all know how strange we look when we see ourselves in profile. Let anyone go to a good exhibition of sculpture and examine the work; he will not find that the artists have tried to reproduce every tiny defect in the faces; for one reason, the defects are not always there, and if they were, there is no reason why a likeness should be dependent upon the fidelity with which they were reproduced; half the world would never have seen them, and the other half would never want to. A sculptor seizes upon the general shape of a head and face, and of the features; he refines upon this up to a certain point, beyond which he does not attempt to go. A painter has a greater margin; he deals with shape and colour. The photographer, like the sculptor, deals with shape alone, and the effect of this shape he knows to be greatly influenced by the colour of the original. He produces a picture in monochrome, wherein darkness or shadow frequently means a part that recedes, and wherein any part on the original which is deep red or yellow becomes darkness in the print. Now it is very certain that if a prominent part of the original be deep red, and this photographs in such a manner that it appears to have the same value and prominence as a part which recedes and is in shadow, a false effect is produced. It is solely to remove manifest defects that we would advocate retouching.

If we have come to the conclusion that a certain pose and lighting is best adapted to one particular head and face, it may be found that this is attended with a small defect, such, for example, as too deep a shadow under the eyebrows, or the cheekbone may be

too marked, some small peculiarity of feature may be emphasized—something we should not observe in the ordinary way. It cannot be incorrect to remove these defects; it is better to do so, and retain the great advantage of the most suitable pose and lighting, rather than to sacrifice these in order that the small defects that accompany them may disappear without other aid.

As to the temporary blemishes that sometimes exist, such as freckles, pimples, patches of colour on the sides of the nose caused by the pressure of a *pince-nez*, it is very difficult to see by what process of reasoning we are to consider them as essential to the artistic fidelity of a portrait. Freckles are brown, the other defects are generally red; and as they can be seen on the developed negative as marks of too great transparency, they will print simply as darkness. A sculptor does not attempt to reproduce them; he knows how futile such an attempt would be. All intelligent photographers are aware of the limitations of their art; they know that, whatever may be alleged to the contrary, photography in colour is not yet an accomplished fact; they know, or should know, that the inability to reproduce the equivalent value of colour is an inherent defect of photography.

But in condemning retouching which is only senseless stippling for the direct purpose of making all faces alike, of bringing them all to one standard of smoothness and roundness, we most heartily join. But that judicious retouching is a very great advantage we have no doubt whatever; it is an absolute necessity, in our opinion, in order to obtain the best result, which is admittedly the object of all art. The commercial advantage of it we do not press, because even the

most bigoted of its enemies do not dispute that. An experience of many years with the highest class of professional work has taught us that it is simply indispensable if one would obtain any pecuniary advantage in the practice of portraiture.

As we consider we have said enough to justify the present chapter, we will proceed to define simply and plainly a few of the necessary considerations in the retouching of portraits.

Before commencing retouching, or, in fact, any minute kind of work connected with photography, it is advisable to ascertain if we are physically suited to it. If we have not good, that is, strong eyesight, any such work as retouching can only be attended with disappointment and failure. If after sitting over our work we get a violent headache, and find that the eyes do not focus accurately, we may assume that the strain upon the sight is greater than it is calculated to bear. This can often be remedied by the use of glasses, and in this connection let us advise. Go at once to a first-class oculist, not an optician, let him examine the eyes, and be guided entirely by his verdict as to whether to continue the work or not. Do not make the mistake of going to an optician; his business is to sell glasses, and although very many are really qualified to give an opinion such as you would get from an oculist, and all respectable houses will deal honestly and straightforwardly, yet it is better to take the other course, and if you are to wear glasses you will get the guarantee of a man fully qualified to direct you to the best place to buy them.

Having concluded that you are fitted for the work, you must next proceed to get the necessary tools. A desk, which can be bought of any first-class photo-

Partially Retouched.

PLATE XXI

[Face page 122.

graphic dealer, pencils, a bottle of retouching medium, a silk rag, and a very sharp knife for scraping the film; a small scalpel is a good knife to use, as it is generally good and well tempered steel, which will not only take a good edge, but keep it. A penknife for sharpening pencils, a piece of smooth sand paper for finishing the pencil points, stumps, sable brushes, and a few water colours such as Burnt Sienna, Sepia, Prussian Blue, will be required; and in every case buy these things from good makers only; the difference in the price of good tools and second-rate ones is not very great, but the difference in their value is infinite.

Let your desk stand in front of a window with a north light if possible, as it is least variable; let it be inclined towards the window at an angle of about 80° with the horizontal, and let the space through which the reflector is looked at be at such a height that your eyes are directed in a line at an angle not greater than 30° with the level of the table at which you sit. If this angle be greater you would have to look down upon the negative, which would make the head ache, apart from the light not being so good. The position of the body should be upright, with the head leaning just the least bit forward, enabling you to slightly alter the distance between the eyes and the negative without moving much in your seat; this movement is necessary in order to see what you are doing.

A mahlstick is necessary; let it be flat, about sixteen inches in length, two in width, about three-sixteenths of an inch in thickness, and made of plain deal, which is light and warm to the touch; let the edges be rounded so that it does not gall the hands.

The first thing to do is to examine the negative carefully, and decide if there is any part that needs scraping

away or reducing with the knife, if so, let it be done before applying the medium. If the medium were put on first, scraping would most probably end in the knife going too deeply into the film, and we should only have the trouble of filling-in. It is very commonly seen in portraits that if the head is much turned the neck will look swollen on the lighter side; this may be reduced with the knife, and we should be very careful that in scraping, the edge of the lighted part is left of the same character as before the scraping, otherwise it will look artificial. If we are taking a small piece from a strongly lighted jaw or cheekbone we should remember that it is a rounded surface, and not a sharp edge; we must, therefore, be very careful to preserve the original character. Sometimes, in order to get a certain pose and lighting, we find that the light has been allowed to distort the nose and give it a crooked appearance; this may be corrected with the knife; stray pieces of hair that are out of place and have caught the light, dense marks in the background owing to imperfections in the emulsion, may be taken out at this early stage, and as much of the work to be done with the knife should also be completed.

Now apply the medium; this is best done by wrapping a piece of silk rag round the forefinger, and tilting the mouth of the medium bottle against it; the medium should be rubbed on with a circular movement of the hand, a little practice will tell you how much to put on, and, indeed, the amount will vary with the kind of medium you use.

A very good medium can be made by dissolving resin in turpentine; this will be found suitable for all ordinary purposes; it dries almost immediately if the bottle be kept corked when not in use. If the medium be

too thick, we shall find that each mark of the pencil will leave a certain glassy look at each side; in this case add a little more turpentine. If, on the contrary, the medium is too dilute, the pencil will not bite sufficiently.

Commence the pencil work by examining the negative, which we will assume to be a large head, and decide if there be any large patches of shadow or half-tone which need lightening; if so, do not attempt to give the surface any special texture, but simply take out the large masses that may seem to be obtrusive and objectionable, commencing with the very worst, and going on by degrees to those that are less evident. When this is done, examine the negative again. You will now find the surface broken up into a great number of small imperfections, less marked than were the larger ones, but greater in number. These may now be removed carefully, attending to the modelling, and being sure that you are not radically changing the shape of any feature.

Now proceed to strengthen whatever lights may need it, and bear in mind that only one point or part of the face will have a very high light upon it, unless, which rarely happens, there be two or more points which are in the same position with regard to the camera and the source of light. It is better to sharpen and clear up the high lights at this stage of the work, because if, as in the case of a very freckled face, we purpose doing very much to the head, we should find that the work we put on round them would cause confusion, and they would lose their distinctive shape.

Any part that has been scraped a little too deeply may be cleared up with the pencil, and the negative is ready to be varnished. Do this cleanly and neatly,

allow the negative to cool, apply the medium again; you may then consider the negative as a new one, without prominent faults, but which needs a little smoothing up.

A great many people who profess to teach retouching insist that the pencil should be used in some particular manner; some say, "work with cross hatching," others advocate a system of spotting, others, on the other hand, say, "make a lot of little marks resembling commas," and so on. All this is delusive; in reality, each uses his own peculiar handling; it is absurd to expect one man to handle a tool in exactly the same way as another. We would say, adopt your own system, and do not follow a single item in our instructions unless you fully understand it and approve of it. As it is a fact that all faces differ in texture, so no one method of acquiring texture by handling can apply to all.

We would draw attention to a few well recognized facts which may serve as a guide to those who have literally no experience of the use of a pencil. Lines drawn in a certain direction, along or across any surface, lead the eye in that direction; a necklace round a lady's neck makes the neck look rounder; so with a bracelet on the arm. The lines across the chest of a soldier's tunic make his chest look broader; vertical lines on a lady's dress make her appear taller. So if in retouching you work with a series of lines, and they happen to print, let them be in such a direction that the surface they are upon is improved by them. For instance, do not make vertical marks on a cheek that is already thin; if the lines show in printing, the cheek will look thinner. Lines across a forehead are not objectionable, that is, if your work shows at

all; even if it does not, it is as well to handle the pencil, so that there can be no possibility of its conveying a wrong impression; but above all, do not aim at giving all faces one common texture, such treatment is absurd; try by your handling to reproduce the texture that is already there.

The Eye.

In considering the eye as a part that needs retouching, the greatest discrimination must be used. It is in most cases better to leave the eyes alone altogether, but there are instances where a little retouching is necessary.

Occasionally we find an image of the reflector on the iris extending almost across the pupil, and making the eyes appear blind. This may be removed delicately with the knife, and a soft light substituted, the light added leaving the shape of the pupil distinct. Do not lighten the whole of the iris, leaving the pupil as a black spot; that will make the eyes stare, and its artificiality will be evident.

Keep the primary high light on the eye in its integrity, unless it is very much too large, in which case it may be reduced with the knife; in doing this it should be remembered that if the high light is above the centre of the eye, and it is necessary to reduce it, much care must be taken that it occupies the same relative position as it had when it was larger: this rule obtains wherever it may be, but it is seldom found below the centre in ordinary portraiture. A somewhat staring eye may be subdued by reducing the upper part of the high light.

Above all, do not attempt to make the eyes sharp

and clear by taking out any half-tone on the white part. This is a very common trick, and is very vulgar, because the eyeball is more or less a sphere, and has lights and shades just as any other spherical body. There is no more certain way of spoiling the life-like look of a portrait than by this clearing up of the whites of the eyes.

The Nose.

In a portrait conventionally lighted, the nose generally receives a very sharp and strong light. It is essential before altering this to observe very closely its shape and character.

The most common error retouchers fall into in this item is, they endeavour to make the two sides of the nose parallel. This is wrong; a little observation will show that although the two sides of a nose are, or may be, equally curved, these curves, representing its sides, really oppose each other. Do not, therefore, attempt to make them parallel, as that will make the feature appear as if it had been badly carved out of wood. Also, do not let your work be too strong, a high light is always sharpest on a surface that has a short curve, such as the front of a nose; but the only part of a face that can reflect a very sharp edged light is the eye, owing to the fact that it has a smooth, glassy surface, such as is not found on any other part of the face. Therefore, whatever you may do to the lights upon a nose, let it be done so that it will not appear artificial when the negative is printed.

The Mouth.

Looking at the subject from an artistic point, there can be very little done in the way of retouching a

Retouched.

PLATE XXII

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mouth. Of course it is possible and easy to alter its character entirely, and sometimes in professional photography this is necessary. Ladies especially will not admit, even to themselves, that their mouths are large or badly shaped, or have lines at the corners, or are otherwise than beautiful; and the professional photographer, if he wishes to live by his work, must bow to their prejudices. There is one item which, however, need not be overlooked—the mouth very often looks larger than it really is, owing to the fact that the lips are red. If a head is lighted from above, the red of the upper lip will appear black, so will the shadow at the corner of the mouth, and these two blacknesses will be so merged and joined together that it is difficult to say where one leaves off and the other begins; the mouth consequently looks very much wider than it would if the picture were in colours. A little judicious lightening of the shadow at the corners of the mouth will give it its proper width, and all the character of the face will be maintained.

Whenever a head is lighted from above, there will be a shadow cast upon the lower lip by the upper; this shadow is always darker than the darkest part of the latter. If we are dealing with a very large head this will be evident at once. Photographic finishers very often make a great mistake in this matter, they know that somewhere inside the outline of the lips there is a broad line of shadow, so, when they are doing the last few touches with gum, they draw a line between the lips, making the upper side of it parallel with the lower; this, of course, is wrong. The line is really the shadow of the upper lip cast upon the lower, the upper edge of the line defining the shape of the lower part of the upper lip, while the lower edge is a repetition of the

upper edge of the upper lip, modified, of course, by the curve of the lower; the two edges of this shadow vary very much in shape, and the proper maintenance of this variation is essential to veracity. Of course the same rule obtains with all shadows, and it is well to bear in mind that a shadow is always darker than the body which casts it. This can be easily proved by taking a small white cardboard box and placing it upon a sheet of white paper. Whatever light it may be in, it will be seen the shadow that it throws upon the paper is darker than any visible part of itself. Consequently, if we are retouching a mouth on a large head, we should observe very closely the shape of the shadow one lip casts upon the other, and do nothing that will destroy or interfere with it.

Sometimes the high light upon the lower lip will be a little too near the corners of the mouth; this will have the effect of making the mouth appear very wide. It may be slightly modified by a little judicious scraping, which must, however, be done very carefully.

The Neck and Bust.

In retouching these parts one's own personal taste will be the only guide to the amount that must be done. If the subject be thin with a long neck, it is better that the posing, rather than the retouching, should be depended upon to remove unnecessary scragginess. If we pose a lady in evening dress, so that the body presents a three-quarter's view, and then turn the head very much, we shall inevitably get a lot of very strong shadow, with hard vertical edges on the neck. If, on the other hand, the figure be posed simply with the head very little turned, the markings of the muscles

of the throat will not be so great, and a very little softening of what is obtrusive will make the neck appear quite round enough to harmonize with the face.

Retouchers should be aware that there are no bones that have any very great influence upon the lights and shades in the front of a human neck. The deep strong shadows of the neck are always the shadows of prominent muscles, principally those used in turning the head, which extend from behind the ear to the inner ends of the collar-bones.

The collar bone, and in some cases the breast bone, shows strongly on a very thin female subject when in evening dress. In retouching a negative of a very thin lady, where these parts are very marked we shall get the pleasantest effect by adding light to the shadows on the neck, and when we come to the chest scraping carefully the light on the prominent collar bone, then blending the light that is left with the shadow so as to leave the general shape of the collar bone, but subdue its very marked character.

Upon the subject of retouching negatives some books have been written which have abounded with anatomical diagrams, every bone and muscle of the face and neck being named and numbered, and the retoucher has been instructed to learn these before commencing to retouch. Such instruction is invariably trash, and the only reason we can see for introducing such matter is, that to anyone quite unacquainted with anatomy, such illustrations give the book a scientific air, and are very imposing—"the unknown is always great." There is no need for such profundity. If the information already exists, well and good; but to cram up such stuff in order to form a code in a matter that is largely one of feeling and taste, is ridiculous.

It is on a par with the impulse that prompts some photographers to store their minds with formulæ. We often meet photographers who can talk most learnedly about chemical action, the laws of light, and other learned subjects; they are perfect encyclopædias of all kinds of heterogeneous information. They will refer to note-books and give you the exact hour and minute when such a negative was taken, will enumerate all the conditions then existing and their subsequent operations, and will end half an hour's rambling talk with some lame apology for a very bad negative of a particularly inartistic subject. It is a curious fact that such superficial scientists invariably produce bad work; the reason is that their ideas are never their own. There is nothing easier than to fill a book with facts, because at the present day the amount of knowledge that exists is very widely spread, and an intelligent person will know where to put his hand upon text-books upon almost any subject that can be mentioned. A judicious selection is all that is necessary, but the power to select judiciously is not so general.

The successful man is the one who knows one thing well. Therefore, we would say do not let us allow ourselves to be embarrassed by attempting to learn details that have no essential value, but begin at the real beginning, and learn the simple facts and principles first. To learn them well takes a very long time. In this work we are endeavouring not so much to elaborately describe any one process or principle, but to point out certain paths that may be followed with safety, trusting that the individuality of each reader will find suitable means of expression in those directions. This is particularly necessary in retouching. To say that such and such a

shadow should be reduced so much, no more and no less, is very egotistical—*de gustibus non disputandum.* Let us rather decide for ourselves individually, how much we will leave of the original negative and how much we will alter, but let that decision be regulated by a purpose, and let that purpose be dependent upon what is suitable.

In the accompanying illustrations, plates Nos. XX., XXI., and XXII., three different stages of one negative are presented to the reader. The first is a rough proof, nothing in the way of retouching having been done to the negative; the second is after the knife has been used, and the attention may be drawn to the alterations made, a small patch of light taken from the hair on the outline above the ear, a small patch from the ear itself, the light on the neck caused by the flesh being forced up by the turning of the head (this light on the rough proof is below the outer edge of the jaw); the point of the nose is very slightly scraped, and where the light has caught the muscles round the mouth it has been reduced; the depression between the eyebrows has been altered by scraping the light from one side, and a touch has been taken from the necktie, that is the extent of the scraping. The third illustration shows the retouched picture. It should be mentioned that this negative has been retouched far more than is, as a rule, necessary. The head was posed and lighted with the distinct purpose of needing a great deal of retouching; it is introduced here to show how much can be done without materially altering the shape of a feature or destroying the likeness. If it be closely examined it will be seen that the greatest piece of work has been the addition of light under the eyes. We have omitted to mention another item of scraping, the light on the

shaded side of the neck has been reduced; this was a reflected light.

In ordinary portraits of ladies this amount of retouching is expected. In cases of ladies who have been noted for beauty, but whose beauty has somewhat faded, this would be considered a small amount of retouching. One might think that eminent men, whose faces are well known to thousands, would object to a so untruthful portrait of themselves going before the public; but it is not so. There seems to be no class, no age, no station in life, no amount of intellectual attainment even, that can divest a man's mind of the idea that he looks younger than he really does; perhaps this is a wise provision of nature, which wilfully blinds us to our own physical, as well as mental, imperfections. Anyhow, the fact remains that scientists, politicians, divines, writers, artists, all are alike in this respect.

CHAPTER XI.

THE FURTHER CONSIDERATION OF DEVELOPMENT.

In the previous chapter we treated the subject of development with great brevity, in order that any more elaborate treatment in that place might not interfere with the clearness of what we wished to say about exposure. We there stated that the ratio of the various opacities produced in the negative by light of greater or less intensity, proceeding from various parts of the subject, remains, generally speaking, constant, whatever the method of development. The only difference that straightforward development can make, will be in what we will call the "pitch" of opacities; the opacity of the various portions will bear some relation to one another, whether it be thin, or whether it be dense.

In the present chapter we propose to show that the above statements are only true when limited by the restrictions there specified, and that the various opacities which should result from light of different degrees of intensity, acting on the sensitive film, can be considerably modified by resorting to different methods of treatment. For instance, if a plate which has been exposed to light of very various intensities is developed in the ordinary way, these intensities will be reproduced in the negative as far as the capacity of the plate allows. If, however, the developer be flowed over the

plate, and as soon as the image commences to appear, the plate be lifted from the dish, and laid face up on a horizontal surface, so as to retain a certain amount of the developing solution, this truthful reproduction of the various light intensities will not take place. The developer on those portions of the plate which have been acted upon by strong light will be used up with great rapidity, and will then cease to cause any further action. At the same time the developer lying upon the shadows of the picture will continue to act, since it is only used or exhausted in proportion to the quantity of silver reduced, and as this quantity in the shadows of the picture is minute, development will continue for a considerable period of time.

The chief uses of such methods of development are the increasing of the contrast in an over-exposed picture, the reduction in an under-exposed picture, and the modification of the negative to suit various methods of printing, or after reproduction. They are of use also in causing the various light intensities reflected from the subject, to be represented in the negative by differences of opacity. The capacity of the plate to reproduce various light intensities being limited, it is often found that the different intensities actually existing are beyond the power of the plate; and it is therefore better, both artistically and scientifically, to let some difference be shown between these intensities, than to represent only a small portion of them in correct gradation, and to allow one end of the scale of intensities, or sometimes both ends, to be represented by one uniform opacity.

In the case of interiors and similar subjects, this power of modification is of very great importance, and is frequently employed by photographers without their

in the least understanding it. It is perhaps this fact which has caused the prevalent impression that an exposure may be anything approximating to correctness, and that the modification of the developer will produce a perfect negative. We therefore repeat the statement that no modification of the developer or the method of development will cause a negative to be a truer representation of the light intensities acting upon it, after the exposure has once been given: development can only modify the scale on which these intensities are reproduced.

The first practical cases to be considered are those of under and over exposure. In a previous chapter we have stated that if a plate will not yield a good negative, when developed by the methods there described, it should be laid aside as useless. We do not wish, in the present chapter, to contradict that statement, which was made with reference to the early efforts of the beginner, and to cases where a second exposure was possible. In practice it is necessary to produce the best possible result from a plate, the exposure of which has already been fixed.

In the case of instantaneous and snapshot work, the exposure may not always be considered with the view of getting a perfect negative; it is frequently determined by the consideration of the rapidity of movement of the object to be photographed, and is consequently very often too short. In this case the best results can be got by increasing the time occupied during development.

The following method is one in which every confidence may be placed. A solution of pyrogallic acid in distilled water or in sulphite solution is made, a very small quantity of potassium bromide is added, together with a fair quantity of alkali (preferably ammonia).

The strength of the pyrogallic acid solution may be from ½ to 1½ grains per ounce. The plate is immersed in this solution and covered up. The development will take place very slowly, and as the light used in the dark room would probably cause fogging of the plate if allowed to act upon it for a long time, the covering up of the dish is essential. If the exposure has been extremely short, it will probably be found that the developing solution will become thick and brown from the action of the air long before development is complete. It will therefore be necessary to throw the solution away, rinse the plate and dish, and apply a fresh solution. The time occupied in thus developing the plate will depend upon the amount of exposure which has been given to it, and may, in obstinate cases, be as much as eight or ten hours. It is always well to consider whether the result to be obtained is worth this expenditure of time and trouble.

Of the more recent developers we can recommend the use of Rodinal (para-amidophenol), and of Metol. Either of these may be used with success. The same principle, however, of dilution and prolonged development must be retained.

Formulæ for the use of these developers will be found in the Appendix; they have been inserted there in order to avoid confusing principles with details. The formulæ there found are for correctly exposed plates, and must, of course, be modified to suit particular cases.

The next case to consider is that of extreme over-exposure. The amateur will, during his earlier efforts, have produced a very large number of negatives which appear full of detail, but very thin and flat. These are over-exposed negatives, and we wish now to show how similarly exposed plates may be made to yield greater

brilliancy and contrast. The character of the negative depends largely, as we have before stated, upon the time occupied in its development; we have shown that a prolonged time is necessary with under-exposed plates, the inference, therefore, is that a short time will yield the best results with over-exposed plates. This inference is correct. The reason of this difference in character is very easily understood. Development consists in reducing the silver salt to the state of metallic silver, and this reduction always occupies a certain time: it is further seen that the more rapid the reduction is, the less opacity will a given quantity of reduced silver cause. This is probably owing to the difference in the size of the reduced particles. If an over-exposed plate, which naturally tends to reduce rapidly, be developed with great rapidity, the more opaque portions will be sufficiently opaque, and time will not be allowed for the reduction of the silver, which would otherwise be found in the shadows. The practical application of this reasoning is that, in the case of over-exposure, the development should be rapid, and therefore the developer should be strong, that is to say, should contain a large proportion of the actual developing agent, together with, of course, a large quantity of restrainer. When developing over-exposed plates by the pyrogallic acid and ammonia method, the pyrogallic acid may be increased to six or eight grains per ounce, and four or five times the usual quantity of potassium bromide added. The proportion of alkali to solution must remain about the same as for a correctly exposed plate.

In the case of interiors, the difference in the light intensities is very great, and unless the ordinary methods of development be modified, the results are

perfectly worthless; those portions near the windows become mere patches without detail, and the portions away from the windows mere black masses, the only detail in the negative being in those parts which have received a medium illumination. The white patches near the windows are due, not entirely to the strong light falling on those portions, but to some extent to what is known as halation, a defect which will be treated of when considering the general treatment of such subjects. In development we are confronted with a plate which we know to have been acted upon by a series of light intensities beyond its capacity; we have, therefore, not to consider the question of producing a true representation, which is impossible with such a plate, but that of the production of a result, which shall represent to the eye a sufficiently near approximation to the truth as the capacity of the plate will permit.

It will have been understood from what we have already said that development should take place with a minimum quantity of developer by laying the plate down, out of the dish. The proportions of the various ingredients to be used must, to a large extent, be determined by the way in which those parts which have received a medium illumination begin to appear.

In some cases, other than those of over-exposure, it is advisable to increase the amount of contrast in the negative. We think we have sufficiently indicated the methods to be adopted. We have now treated of the best methods to be adopted for development, where the developer is applied to the whole film.

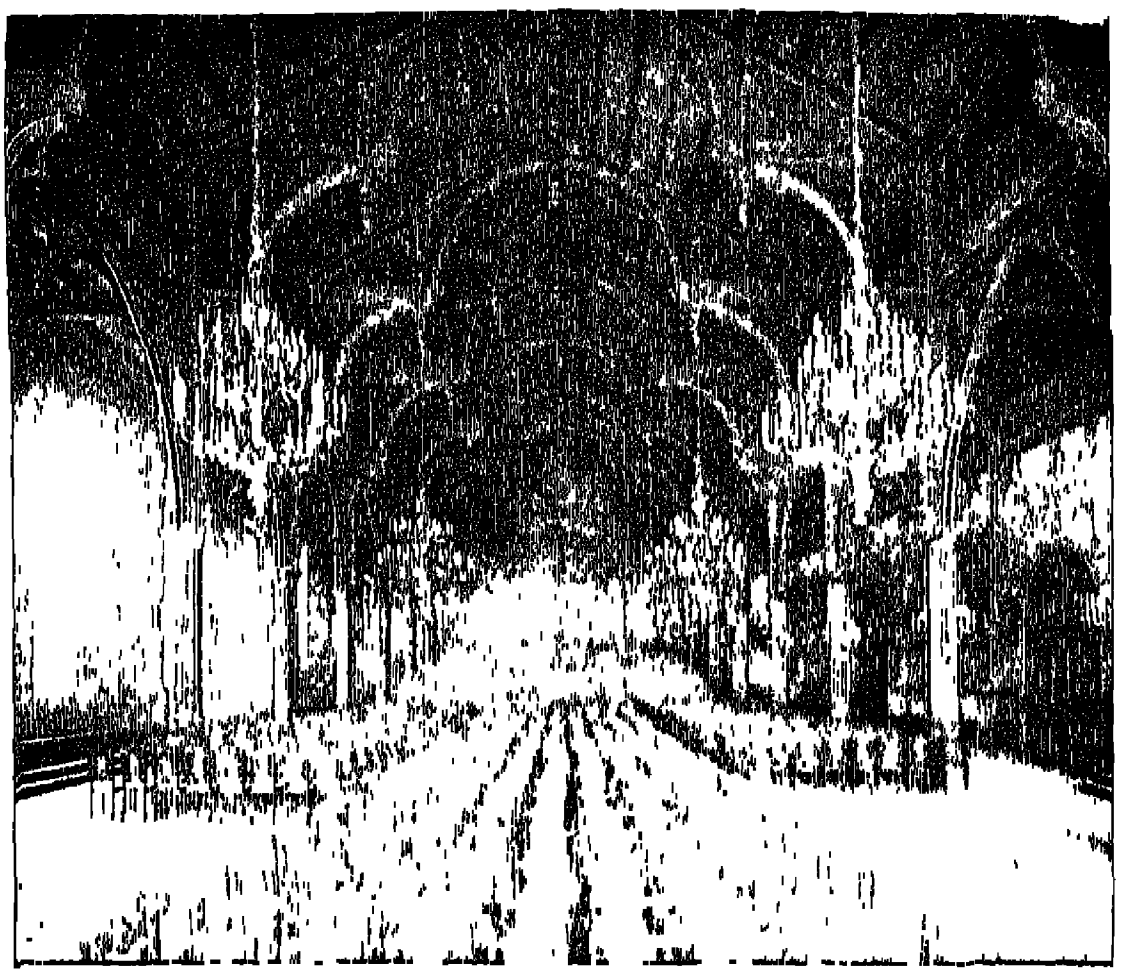
It is, however, frequently possible and advisable to apply the developer locally. The plate is immersed in the developer in the ordinary way, and as soon as the

image has appeared sufficiently to show the shape and size of the various portions, it may be removed from the dish and well rinsed. It is then immersed in a mixture of glycerine and water for a few minutes. The developer is prepared and incorporated with a small proportion of glycerine : the constitution of the developer having been determined from the appearance of the image whilst under treatment in the dish. A camel-hair brush is dipped in the developer, which is applied to the film on those portions which require to be rendered more opaque. The glycerine serves two purposes. Firstly, it prevents the portions of the film touched by the brush from being identified afterwards, by reason of a sharp outline. Secondly, it acts as a restrainer, mechanically preventing the rapid action of the developer in the film. In order to attain success by this method of development, it is of course necessary that the developer should be so mixed as not to have an extremely rapid action. The greater the skill of the operator, in the use of the brush, the greater is naturally the rapidity with which this method may be employed.

We had the pleasure once of seeing a most convincing proof of the possibility and usefulness of brush development. One of the most skilful operators exposed a plate in the printing frame under ground glass to a feeble light for a few seconds: he then developed a negative of a head, entirely by the use of the brush. Such a feat was, of course, a proof of very exceptional skill, and was nothing more than an interesting feat.

We have alluded to the use of the brush in intensification and reduction, and trust that what we have now said will show how these operations are practically performed.

One of the recent developers, hydrochinone, seems to have become a great favourite with most amateurs, since it is very clean to work, and yields negatives of good colour; it also develops rapidly. This developer is one which can be highly recommended in cases of approximately correct exposure, but our experience of its use classes it as many degrees inferior to pyrogallic acid in cases of other than correct exposure. Negatives from which blocks for letterpress printing have afterwards to be produced, are, however, very satisfactorily developed by its means. Of the other developers, eikonogen, amidol and glycin, we have not had so great an experience, but we at present see no reason why they should supersede or even compare with pyrogallic acid.



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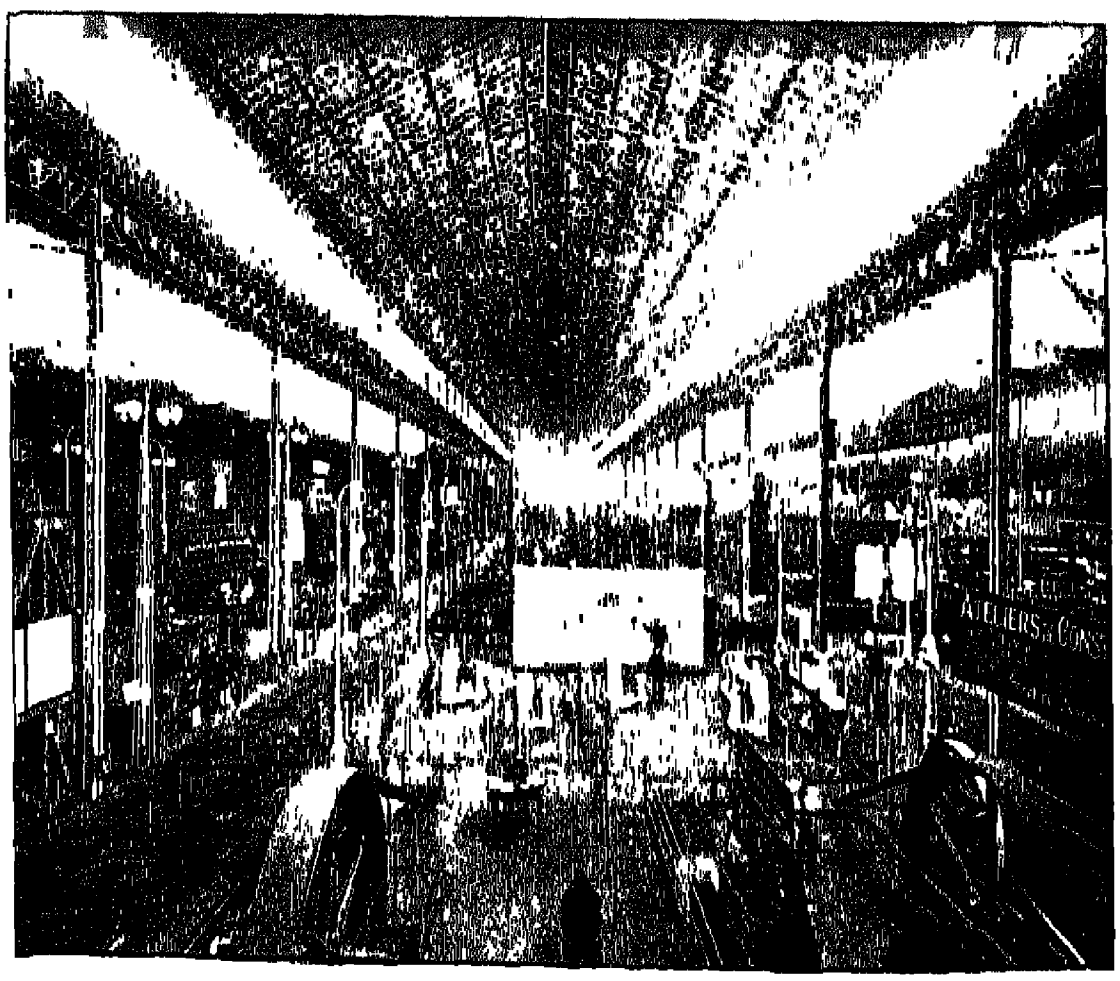

No. 2.

PLATE XXIV.

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CHAPTER XII.

TREATMENT OF INTERIORS AND DIFFICULT SUBJECTS.

The difficulty of producing a pleasing photograph of any particular subject may arise from several causes: from the fact that there is so little space that a very short focus lens must be used, causing the exaggeration of the *perspective* to be so great that the result is vitiated; from the presence of halation; from the presence of excessive contrasts of light and shade; from the lack of contrast, and from the unsuitability of the sensitive plate to the particular purpose.

We give in Plate XXV. an example of the distortion, or rather, exaggeration produced by the use of a very short focus lens. The objective here used was a wide-angle specially made by Wray, its focus being 0·571, or about three-fifths of the length of the plate. The effect is seen in the apparent contraction of the height of the towers compared with the height of the roof at the east end of the church; the spires are 156 metres high, whilst the main roof is only about 60 metres.

In this case it would have been possible to avoid this only by choosing a point of view much further away, and at a considerable elevation. We should like to digress here in order to point out that in the case of photographs of famous scenes, such as the one under discussion, it is always advisable to photograph from

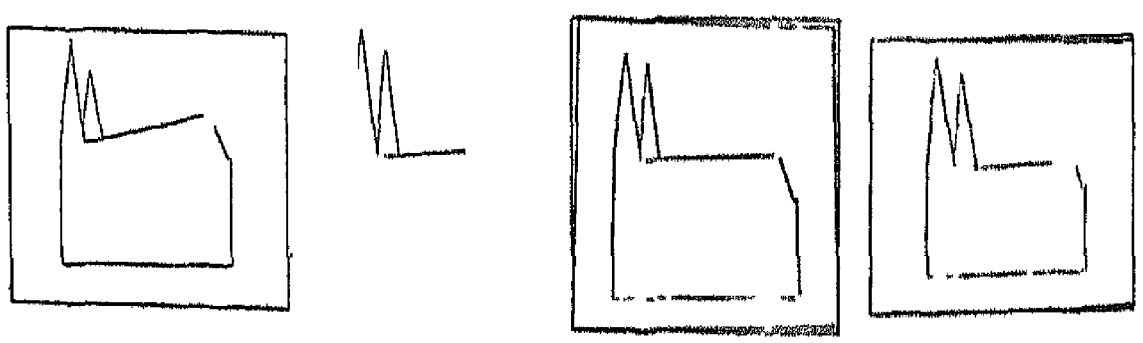
some point of view easily accessible to the public. The practice of choosing a house-roof from which to take a photo is unreasonable, since the public seldom if ever view the scene from such a point.

In considering this view we determined that the view from the ground level in the square would be preferable to any view having a foreground of house roofs, or taken from a high point of sight, even without such an inappropriate foreground.

In thinking over the matter afterwards we considered that, in a view of so great importance and architectural beauty, if we could do away with the objectionable exaggeration, no amount of time or trouble spent on the matter would be too great; we therefore designed the following method, which has been carried out, with the result shown in the second illustration on the same plate.

The negative was placed in a frame at a considerable angle with the axis of the lens, the towers being nearest to the camera, of course. A transparency was then made, using a lens of very short focus. The transparency, a vertical one, was inclined at an angle, and re-photographed so as to foreshorten the height. The convergence of the vertical lines towards the top of the view can be minimized by the use of a lens of long focus.

This method will be better understood if we give a series of rough sketches.



Of course, if the convergence of the vertical lines caused by the inclination of the transparency is too marked, as was seen in the case under discussion, it can be avoided by reducing its inclination to one-half that required, then re-photographing the negative so produced, at the same inclination but having the other end nearest the camera.

This method is useful in very many cases, but requires, of course, specially arranging to suit each particular view.

It will be sometimes found, that in photographing the interiors of churches and very dark buildings, it is impossible to see the image on the ground-glass sufficiently clearly to enable the focussing and arranging on the screen to be done with any certainty. We have on one or two occasions been unable to see to focus at all, and have been compelled to measure off the distance of the object which we should have focussed, taken the camera out of doors, and focussed it for an object at the same distance. We have then brought the camera in, noted carefully that the plate was vertical, stopped down the lens to a very small aperture, and made the exposure.

In one or two cases we have desired to give to an interior an exposure of three or four hours, with a very small stop, but have been unable to do so on account of the frequency of the services in the church or for some other reason; we have found it necessary to use a larger stop, therefore, and in order to get a better focus, we have inserted a small diaphragm during a portion of the time.

We remember particularly one case where we desired to give an exposure of four hours at $f/64$, but we were obliged to take our photograph between two services,

and could only get an hour and a half. Had we used a stop of $f/44$ two hours would have been required, whilst at $f/32$ only one hour would have been needed, and half an hour would thus have been wasted. We therefore gave an exposure of fifty minutes with $f/32$, and turned the stop round, without shaking the camera, to $f/64$ for the remaining forty; the exposure at $f/64$ being equivalent to ten minutes at $f/32$, which together with the fifty minutes at $f/32$ gave us an equivalent exposure of one hour at $f/32$, with the advantage that the picture was sharper than had we used $f/32$ throughout the whole exposure.

It is sometimes possible to improve the subject by modifying the light. In the case of the interior shown in No. 1, Plate XXIV. this was done by closing the curtains, so as to avoid the excess of light near them, and then opening them during a portion only of the exposure, sufficient to render the windows the most opaque part of the negative.

Photographs of machinery and engineering works are always difficult, as the sharpness must be perfect and the various parts cleanly and strongly defined. We think that what is required will be understood from the lower illustration on Plate XXIV. We have, we think, in the present and last chapter said sufficient to enable the amateur to think out such cases for himself.

What is known as halation is the spreading of the image on the plate when receiving a very strong light. This phenomenon is most marked in interiors where windows are shown. All detail in the window and its neighbourhood is obliterated, and is simply represented in the print by a large white patch.

Halation owes its origin to two causes, the strong

light striking the particles of silver salt is reflected from their sides, and attacks those particles on which it falls at each side. The greatest cause, however, is that a certain portion of the light is not absorbed by the film; it passes into the glass plate, and a portion being reflected back from the interior of the plate, attacks the sensitive film from behind.

Many methods have been suggested for avoiding this difficulty, among which the chief have been the thickening of the sensitive film so that it should pass less light, and so allow less to be reflected back; and the coating of the back of the glass plate with some non-actinic pigment. Neither of these methods has however proved entirely successful. The thickening of the film, while reducing the second cause of halation, has increased the first, and is objectionable for other reasons. The second method certainly caused an improvement, and was largely adopted, but it did not secure entire immunity from the defect.

A special plate known as the "anti-halation" plate has recently been invented, which appears from what we have seen to be satisfactory. The exact preparation of the plate is a secret, and the subject of a patent; it appears that the glass plate receives a preliminary coating of some opaque or non-actinic character, and that the sensitive film is superposed. The backing is of such a nature that it disappears on development.

One of the authors has for some time adopted the practice of coating a glass plate with an indiarubber film dyed to a deep orange colour, superposing the sensitive film. In this method, however, it has, of course, been necessary to strip the sensitive film away from the indiarubber before printing.

The question as to how far it is desirable to do away

with halation is one which must, of course, be decided by the individual in each case. In photographing a monument situated close to a window in a church, for example, halation should be avoided, since the monument is the principal object; but in taking a general view of the interior of such a church it should, in our opinion, not be altogether absent, since the eye suffers to a certain extent from halation in such a case.

A reference to the previous chapter will suggest a method of mitigating the effects of this phenomenon by suitable development.

The reduction and increase of the contrasts impressed on the sensitive plate has been treated at some length in the last chapter, but in that place we only examined the influence of development in this connexion; whereas it is not necessary to expect the development to do the whole of the work.

Let us consider the Swiss scene described in the introduction. We are here confronted with a view which we know to have a scale of light intensities much beyond the capacity of our plate, and that the ordinary result would be a patch of black and two patches of white.

However true the rendering of the lake, sky and mountain tops may be, the result will be extremely unpleasing if the darker portions of the picture, the foliage and rocks, are all represented by a black patch; we must, therefore, have a certain amount of detail in these darker parts.

This detail can only be got by an exposure which is too long for the lighter parts of the picture, so that a compromise will be necessary; but since it is easier to prevent the choking up of the high lights during

development than to produce detail which is not present on the plate, it is better, in fact essential, that the exposure should be determined by a consideration of the shadows.

In the case under consideration, correct exposure for the darker parts of the picture would probably be five or six times that needed for the lighter portions. In our opinion the best course will be to give an exposure *of about one half that which would be given if the* darker parts alone were considered, and if the development take place with a powerful developer, the detail in the shadows will appear before the high lights "choke," especially if the plate be lifted from the dish.

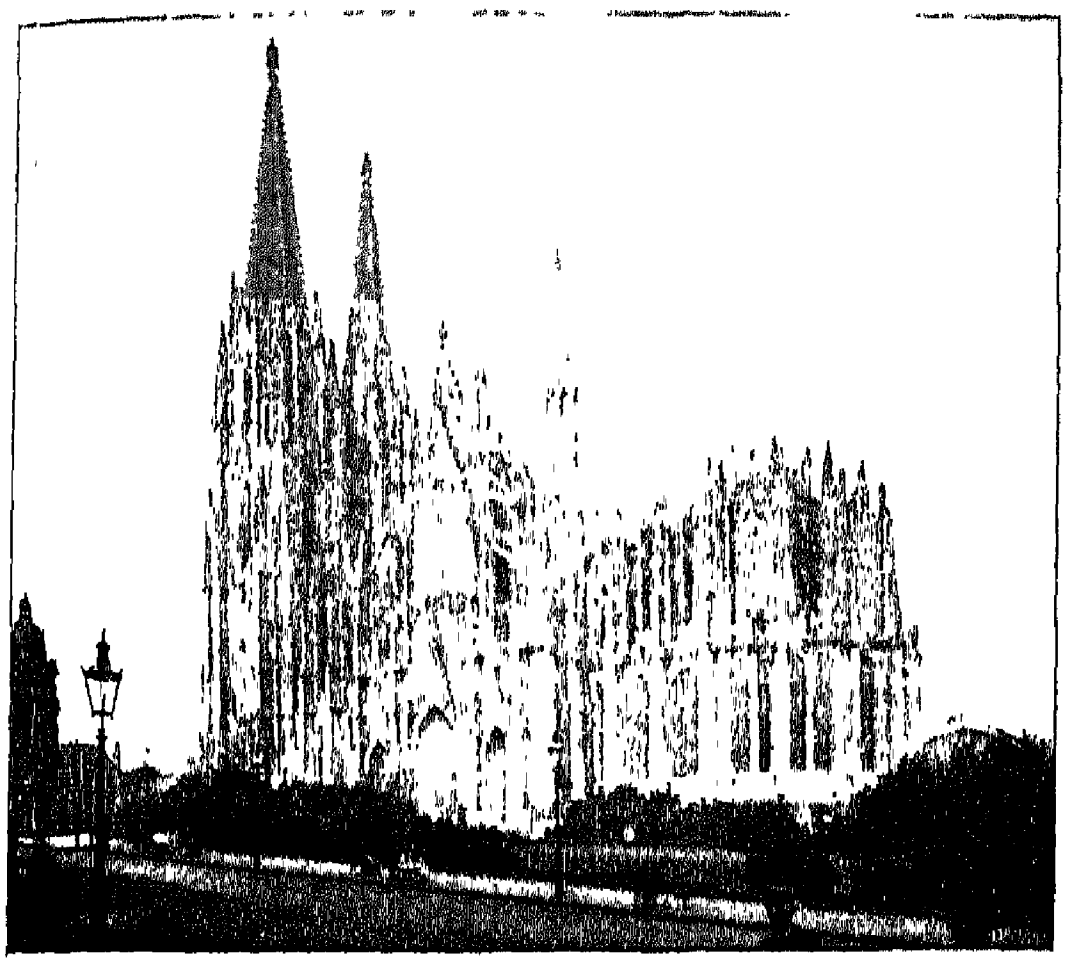
The same method is suited to interiors where the contrasts are as a rule very marked.

When this method is adopted, it may be found that *the negative will be very thin, especially when development* takes place in a few seconds, and that any attempt to gain density in the developer will defeat the object in view, or will even fog the plate. Intensification should be resorted to in all such cases, and if, as frequently happens, the intensified negative is not sufficiently opaque, a transparency may be printed by contact, and a fresh negative made, having the required opacity.

The main secrets of success in *difficult* cases are to have a thorough knowledge of the apparatus and materials at our disposal, and to consider the subject very carefully before taking any step towards its reproduction; this knowledge will clearly indicate the possibilities, and the consideration of the subject will point out the difficulties which it presents, and will enable the photographer to determine beforehand the

methods he will adopt to overcome them or to minimize their effects. He will find that the time thus spent will not be wasted, as it will not only conduce to a better rendering of the particular subject to which it is devoted, but will widen his experience, and in time render him capable of at once judging the photographic character of a view.

We have been able to discuss in this work only a very few of the most prominent cases, but if these are carefully thought over the amateur will be able to deduce many others for himself.



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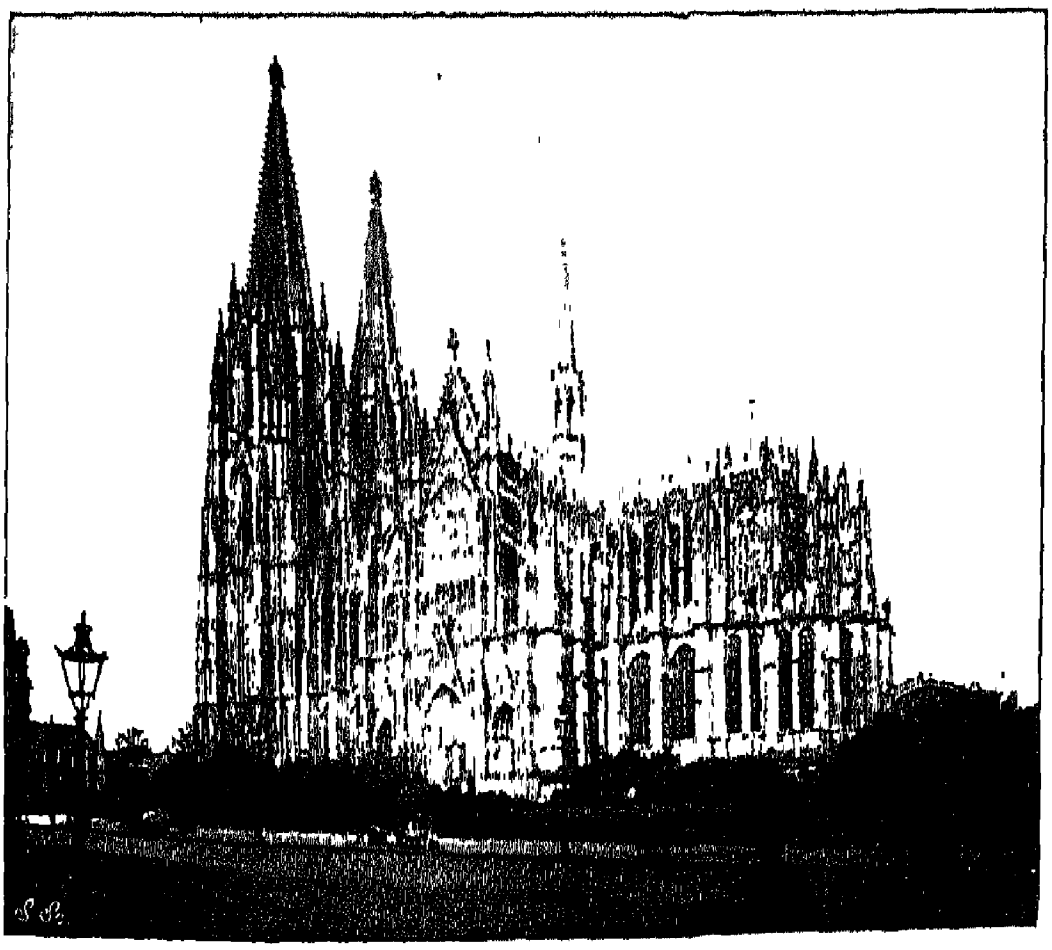

No. 2. *Distortion Corrected.*

PLATE XXV

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CHAPTER XIII.

PRINTING PROCESSES.

In order to facilitate the correct choice of a printing process suitable to any particular negative, we propose to describe very briefly the chief characteristics of some of the best known processes. The amateur will find that a reference to Plates XXVI. and XXVII., which are close imitations of prints obtained by these processes, will be of great help to him.

The three great differences between the various printing processes which we propose to describe in the subsequent chapters, are colour, surface, and capacity for showing detail.

It is often considered that the process by which a good negative is printed to obtain positives is a matter of little importance, but if we think for a few moments we find that this not so; for instance, it would be quite absurd to use a plain matt surface salted paper to print a negative whose beauty consisted chiefly of the minuteness and perfection of its detail—a negative such as our frontispiece or Plate XXVI., for example; equally absurd would it be to print a negative whose beauty consisted in the breadth of its composition,

in its bold massing of light and shade, and in which the detail was lost to sight in the general effect, by an enamel process such as that of which our frontispiece is an imitation.

Every good negative has some feature particularly its own, and it is this principal feature which must decide the method of printing.

In deciding on the colour to be employed, we think that the colder the effect of the subject the colder should be the colour of the print.

Supposing that we had a good photograph, taken in the early morning, representing a stream before the morning mist had risen; a beautiful effect; yet how inadequate would be any process giving a rich warm tone to represent it. A snow scene printed in a warm colour does not make us feel inclined to shiver and draw our overcoat more closely around us; the colour contradicts the effect of the scene and interferes with its truth, it is therefore bad.

Having thus conveyed a general idea of our meaning, we proceed to classify the various processes, but before doing so we may say that as a rule the less brilliant the surface of any printing paper the less detail is it capable of representing.

With reference to surface:—

Matt: platinotype, salted paper and gelatine papers squeegeed to ground-glass.

Semi-matt: gelatino-bromide and collodio-chloride.

Semi-brilliant: albumênized and gelatino-chloride.

Brilliant: any of above, enamelled.

We have not included the carbon process in the above classification, since any desired surface may be obtained by alterations in the method of transferring.

With reference to colour:—

Warm: sepia platinotype, albumenized, salted, gelatino-chloride and collodio chloride.

Cold: platinotype, gelatino-bromide.

With reference to their capacity for representing minute detail we have the following order:—

Gelatino-chloride, albumenized, collodio-chloride, platinotype, gelatino-bromide, and plain salted.

Carbon it is impossible, as we have said, to include in the above classes, since the finer the grain given by the method of transfer the more brilliant the surface and the greater the detail, and *vice versa;* and further, any colour can be given at will by employing suitable pigments in making the tissue. The standard tints are, however, standard brown, sepia, red chalk, indigo, and engraving black. In this connection we would like to say a word or two on the subject of the choice of the colour to be employed, as well as the texture to be obtained, in the mounting of carbon prints.

Let us suppose we have to enlarge a photograph representing the head and shoulders of a lady taken in what is often a very beautiful lighting. The subject is turned full face towards us, with very little animation in the pose of the head and figure; the light falls from a point high up behind the sitter, the face will be in shadow; but if a large concave reflector be brought up near to the face and bust, the whole of the subject will be illuminated by a soft reflected light; the primary light will produce a halo round the head as it falls upon the hair; the shoulders will be strongly lighted on the upper part, the face and bust all being in very delicate half tone; the eyes will appear clearly without any deep shadows near them; in short, each feature will owe its prominence to the fact that it is lighted from below. If such a head be enlarged, a very suitable

method of printing will be in warm brown carbon mounted upon Creswick drawing-paper, which has a very rough granulated surface. Such a head printed in any process with a highly glazed surface would appear hard, flat, and very uninteresting; but in the method we have indicated, the roughness of the drawing paper will give the effect of a sepia-drawing.

If the negative of a head (either male or female, it is immaterial which), very strongly lighted, with deep clear shadows, be considered, it will probably be decided that the effect is too hard and bright. It will be found good policy and good taste to print this in platinotype, either black or sepia, or on plain salted silver paper, producing a matt surface; the contrast between the lights and shadows will be lessened.

The reason of this effect is that the minute irregularities of the surface reflect more light in the case of the shadows than would a highly glazed surface, while in the lights the irregularities cause tiny shadows; the result being that the lights are darker and the shadows are lighter than would be the case with a polished surface. Such a print will look like an engraving or a drawing in India tint or soft purple.

So it may be assumed that if it is desired to increase the contrast in printing, one of the more glazed or polished processes, such as gelatine or albumen, should be used; while on the other hand, if it is advisable to reduce the contrast, a surface that is dull like carbon should be adopted. In the case of large heads, the print, if in carbon, should be mounted on a very rough paper.

Carbon will give a greater amount, and greater delicacy of detail than platinum, especially if the paper used for the platinum be very rough; and besides these advantages, any large surface of delicate half-tone, when

printed by the carbon process, loses none of its beauty, but is transparent and pure.

Photographs printed upon ivory and intended for colouring as miniatures, will be found best printed by the carbon process in standard brown and rather under-printed, especially if the negative be strong in contrast.

Photographs of winter scenery, where an effect of intense cold is aimed at, such as a snow-covered landscape, may be printed in black platinum, as the contrast of the light and shade in such scenery is sometimes very strong. A leafless tree borne down by the weight of snow looks very black and white if we compare the upper and lower side of the boughs, while the trunk stands up stark and bare, and appears very black against the pure white surroundings. The same effect exists in rock scenery, those parts which are not covered with snow looking black and sombre; platinum, therefore, will be a suitable style of printing to adopt for such a scene.

But if we have a negative of a glacier—the photographer of the present day is so ubiquitous that one can hardly visit any of the well-known glaciers in the direct line of tourist travel without seeing some one at work with his camera—it will be found good judgment to print such a picture in indigo carbon, especially if the position of the camera was so near the ice that the fissures and crevasses are plainly visible. We shall not by this means produce anything that correctly represents the colour of the original; indeed, we have never seen any painting that approximates to it; the pure delicate blues of ice seem to be beyond the skill of man to portray. If we stand on the edge of a crevasse and look down, we see how the colour deepens and intensifies until the depth may be gauged by the intensity of the colour. Those of our readers who have stood in one of

the ice-grottoes that are hewn out of the solid mass of a glacier, will be aware that no pictured representation could correctly convey the impression produced upon the mind by the almost unearthly character of the colour. A photograph in such cases is simply a record or note, and can never be in any sense a reproduction of the scene; it, however, records the shapes, and may, with propriety, be printed in some material that will give a faint suggestion of our experience. Indigo carbon mounted upon a smooth white card will be the best method of printing such a subject.

Carbon in Bartolozzi red is sometimes good for printing large heads, but it should be borne in mind that this colour can only be used when printing a head or figure which is very light and delicate in character. It is to be preferred in the case of vignettes, rather than in heads which are printed with a background extending to the edge of the picture: a vignette is supposed to have some of the character of an artist's sketch. If the photograph is intended to convey the impression given by a red chalk sketch, it should be printed in red carbon, but not otherwise.

In photographs of architecture, machinery, jewellery, and in fact any object where great precision of shape is required, where detail is of more importance than any other consideration, the best effect will be got by printing on one of the highly glazed papers. But even in such photographs it is possible to display bad taste in the selection of the colour to which the paper is toned; a black tone being extremely suitable, whilst a warm tone is much less so. In architectural subjects a little variety must be allowed; for instance, a picture of a suburban villa, built in the style known as Victorian, and largely consisting of red brick, may be printed in one

of the gelatine papers and toned a warm red, the paper being left of a semi-brilliant finish. If a building is yellow in tone, we may repeat the colour as nearly as possible in our photograph.

All portraits larger than full and three-quarter length cabinets are best printed on paper with a matt surface, whether silver or platinotype. We know nothing that has a more interesting effect than platinum of a warm brown, known as sepia platinotype.

There is great misconception, by-the-bye, on the subject of the colour called sepia. Few people who are not artists are aware that sepia is a greenish black, not a brown at all; we suppose this mistake is too general to be easily corrected, and so long as we arrive at the colour we want, it is of no importance by what it is called; it would still be the same colour if called by any other name.

Portraits printed in silver should, in any case, be toned a warm tint, the lights inclining to pink. A cabinet portrait is a thing to be looked at closely; the detail seen in it will be greater than ever exists in a painted miniature, and if it be toned very cold and black the result will be displeasing; for instance, in the portrait of a lady with dark hair and wearing a dark dress these subordinate parts will be right, but the face will be sacrificed to them. If we cannot modify our colour to suit all parts, let us at least save the most important part, and sacrifice the others to it.

We think we have said enough to indicate that it is necessary to exercise one's taste and judgment in the selection of the kind of paper to be used for some types of photograph. It is impossible to enumerate one hundredth part of the different classes of pictures that may be taken; all we can do is to point out that

the care and selection we display in the preliminary processes must not be wasted by want of care in the later stages, if we would that our work should be of a high order.

A large part of the manipulations necessary are common to all printing processes. There are several patterns of printing-frame, but the principle of all is the same, and provided that they are well-made and convenient to handle, there is no great reason why one should be chosen rather than another. The usual form is a simple frame, like a picture-frame, provided with rebates on which to rest the negative, and having a back with hinges across the middle. The back is pressed towards the rebates by two strong springs, one pressing on each half of the back. This form is eminently satisfactory for negatives of 8 × 5 inches, or less; but for larger negatives the rebates should be deeper, with a thick plate of glass resting upon them, the negative being laid upon this glass. For sizes larger than 15 × 12 it is convenient to have the back in three parts, and, of course, with three springs, one pressing on each part.

The negative, after cleaning its glass side, is laid in the frame, film side upwards, care being taken that there is no dust or grit on the plate-glass; the paper is then laid face down upon the film, and a pad composed of felt, indiarubber, or blotting-paper, superposed to render the pressure more even; the back is put in position and the springs closed. The print may be examined in course of printing by loosening one of the springs and raising one half the back, so that one half can be turned back. One half the frame only must be opened at one time, or the paper will be shifted.

Before proceeding to make a number of prints, a trial print should be taken to see whether the light and shade are satisfactory. This will probably not be the case, at any rate with a landscape negative, and the negative must be prepared by the use of tissue paper or by other means. This process is often called "dodging in printing," and has been most irrationally condemned by many experts. Of course, if negatives can be produced which do not require it, so much the better.

The first point to be considered is the light in which to print, since the same result will not be obtained from the same negative by printing for, say one hour in a strong light, as for two hours in a light of one half the intensity. The stronger the light in which printing takes place the weaker will be the resulting print in contrast, and *vice-versa*. A negative, therefore, in which the contrasts are too strong should be printed in sunlight, if possible, whilst a negative in which there is little contrast will give a better result if printed in the shade, and even covered with a piece of ground-glass, or two or three thicknesses of tissue paper.

In the case of an under-exposed negative, where the shadows over-print before the detail in the light is sufficiently strong, an improvement may be made by coating with a thin emulsion, on the glass side of course, exposing to the light of a candle through the negative, and developing this film to a suitable degree of opacity, fixing and washing.

The above method is not advisable, except in very skilful hands, as there is great danger of staining the negative. A simpler method is to lay the negative, film down, in a printing-frame, on this place a sensitive plate, film down, and expose to a candle as before. There is thus no risk of injuring the negative; the

transparency can be developed and fixed like an ordinary negative, and when dry be again exactly superposed on the glass side of the negative and bound to it by strips of gummed paper round the edges. The transparency will, of course, be most opaque in the shadows, whilst the high lights will be clear glass, so that whilst the printing of the high lights is not interfered with, that of the shadows is rendered slower.

Tissue paper may be gummed to the glass side of the negative, over the shadows, or pieces of ground-glass may be laid upon them, but unless the glass of the negative is of considerable thickness there is great danger that the edges of the tissue will be shown in the print.

The contrast may be increased by similarly covering those parts which it is desired to lighten with tissue, or by painting them in on the glass side of the negative with water-colour.

The transparency method can also be utilized: a transparency is made as above described, but not fixed; it is then immersed in dilute nitric acid till all the image produced in development is dissolved away, leaving those portions of the plate unacted upon by light as bromide; the plate is washed, exposed to a very feeble light, then re-developed and fixed.

Contrast may be diminished by printing under blue, and increased by printing under yellow glass.

In portraits, it is often desired to vignette the head, that is to say, to print the head in full strength, but to shade off the body and background. There are many methods of doing this, but the simplest is to cut a hole in a piece of card of the size of that portion which is to be printed full strength, and to place this card above the negative. The printing must be done in diffused

light, since sunlight would form a distinct shadow of the edge of the opening. The distance between the card and the negative may be modified according to the rapidity with which it is desired to shade off the edge of the print; about ¾ inch gives a nice shading in a cabinet head. The hole may be covered with ground glass or tissue paper, in fact this is generally advisable.

CHAPTER XIV.

SILVER.

It was stated in Chapter I. that when light acted upon silver bromide an atom of bromine was set free, and that the action on silver chloride was similar, that is to say, that an atom of chlorine was liberated; it was not thought advisable to point out in that place the difference in the two cases which, as a matter of fact, is slight. In the case of the bromide a somewhat prolonged exposure is necessary to produce perceptible darkening of the compound, and development must be resorted to for the production of an useful image; the chloride, however, darkens rapidly. The practical process of silver printing on albumenized paper depends not only on the action of the chloride, but on that of a sensitive compound formed by the combination of the albumen with the silver nitrate. This compound, known as the albumenate, is of great importance, since it gives force to the image, and the study of its action is essential to the practical printer.

It has been found that whereas the action of light on silver chloride is a co-efficient of the duration of the action and the intensity of the light, the albumenate does not obey the same laws, being almost unacted upon by weak light, and being capable of what is called continuating action, that is to say, that having been

exposed to light the action will still go on in darkness or in yellow light.

The practical importance of the albumenate rests upon the fact that the greater the proportion, beyond a certain point, of albumenate to chloride present in the paper the less vigour or contrast will such paper produce. It is probably also owing to the albumenate that silver prints are so liable to fade. In sensitizing the paper the chloride of silver is formed much more rapidly than the albumenate, so that in a paper containing a large proportion of soluble chloride a smaller proportion only of albumenate will be formed during sensitizing.

Albumenized paper can now be obtained of excellent quality and at a reasonable price; its preparation is exceedingly troublesome to the amateur; we therefore omit a description of this portion of the process, as we advise him to purchase it ready prepared, and to sensitize it for himself. It can also be bought ready sensitized, but is not so satisfactory as freshly prepared paper, since, in the first place, some other substance has to be introduced to make the paper keep, and secondly, it is, as a rule, sensitized on a somewhat weak silver bath.

The strength of the silver nitrate solution with which the paper is sensitized is of great importance, and should be varied to suit the character of the negatives to be printed. If a piece of albumenized paper be floated for some time on a weak solution of silver nitrate the albumen will dissolve off the paper, since it is soluble in water; it is, however, insoluble, and coagulates in a strong solution of silver nitrate; this coagulation prevents, to a certain extent, the free access of the solution to the interior of the film.

It has been found practically that the sensitizing

bath may contain from thirty to a hundred grains of silver nitrate per ounce, and that the best results are obtained by using a weak bath for hard negatives with strong contrasts and a strong bath for weak negatives.

The addition of certain other salts which will cause a certain amount of moisture in the paper has been recommended. In England this is scarcely necessary even in summer, but in a hot, dry climate, such as is found in certain parts of India, their addition appears to be desirable, since absolutely dry albumenized paper prints only with great difficulty. The chlorine, liberated from the silver chloride under the action of light, attacks the albumenate unless a certain amount of moisture or some other compound with which it has greater affinity is present, causing a defect known as "measles."

The difficulty that the amateur has to contend with in sensitizing his own paper consists chiefly in keeping the bath in working order. As originally prepared it should be neutral, that is to say, should show no acid or alkaline reaction with litmus paper; the tendency is for it to be acid, since silver nitrate has generally an acid reaction; a few drops of sodium carbonate solution will remedy this defect, as silver carbonate is precipitated and though insoluble in water will combine with any nitric acid which the bath may contain, forming carbon dioxide and silver nitrate.

After the bath has been in use for some time, it will be found to be contaminated with organic matter obtained from the paper, and if used in this state stains, and uneven sensitizing will result. A good method of eliminating organic impurities is to add a teaspoonful of kaolin to the bath and after shaking up two or three times to allow it to settle, when the kaolin will carry

the organic impurities down with it: the clear solution may then be filtered or decanted off. A few drops of hydrochloric acid will form a precipitate of silver chloride which will have the same action, but will cause acidity of the bath by the formation of nitric acid. The most efficacious method is, however, to add sodium carbonate and expose to bright light, when the organic matter will be oxidised and a precipitate of metallic silver formed. Eventually the soluble nitrates caused by the double decomposition of the silver nitrate of the bath and the soluble chloride in the film will be in great excess, it will then be necessary to precipitate the silver, convert it into nitrate, and make a fresh bath.

It is important to know the strength of the bath at any time; to ascertain this, take 1 drachm of the solution, dilute it with, say, half a pint of distilled water, then precipitate the whole of the silver as chloride or as bromide with the minimum quantity of a solution of a metallic chloride or bromide of known strength; the amount of silver present can then be calculated from the quantity of chloride or bromide used. "If 20½ grains of salt (sodium chloride) or 42 of potassium bromide be dissolved in 1 ounce of water, then each minim dropped into the drachm of silver solution" to just cause complete precipitation will indicate "the number of grains of silver nitrate per ounce."[1]

The practical manipulations required in sensitizing the paper are neither difficult nor tedious. A dish an inch or two larger each way than the sheet of paper to be sensitized is filled to the depth of at least half an inch with the sensitizing solution; the sheet of paper is held

[1] "The Art and Practice of Silver Printing," Captain Abney and H. P. Robinson.

by two opposite corners, albumenized side downwards, and lowered on to the solution, the middle of the paper of course touching first; the two hands are now separated and lowered so that the whole sheet is rapidly brought into contact with the solution without the least stoppage—the slightest stoppage would probably cause lines of unequal sensitiveness. The corners should now be raised one at a time, and any air bubbles which may have formed on the surface of the paper be broken with a glass rod or a clean quill. After floating upon the solution for from two to five minutes the sheet is slowly raised by one corner and hung up by an American clip to dry. Any dust or scum on the surface of the bath may be removed by drawing a strip of pure blotting paper across its surface before floating the paper.

The time of floating is important and depends upon the strength of the bath; a bath of 30 grains to the ounce requiring about two minutes, and a bath of 80 grains five minutes. Care must be taken to keep the corner which last left the solution the lowest during drying. A small piece of blotting paper will easily stick to this corner, and will prevent the solution dripping on to the floor; if the amateur is in the habit of saving the trimmings from his prints and other residues, these bits of blotting paper may be put with them.

Great care must be taken that none of the sensitizing solution gets on the back of the paper, as it will cause stains.

As soon as the paper is surface dry, it may be hung in a special cupboard supplied with a current of fresh warm air. It should at any rate be rapidly dried, since otherwise the surface is apt to lose its brilliancy.

Paper thus prepared yields, as we have said, better

results than paper that has been sensitized on a bath to which any preservative salt has been added, but it cannot be relied upon to keep more than a couple of days in summer or a week in winter owing to the action of the free silver nitrate.

If the paper is required to keep, some modifications in its preparation must be made.

After sensitizing, the paper may be freed from the excess of silver nitrate by drawing twice through distilled water; two dishes are filled with distilled water, the paper drawn through them and then dried as before. This paper requires fuming with ammonia before printing, as otherwise it is very liable to print flatly or to have "measles."

The cause of "measles" is not far to seek, since we know that the chloride is reduced by the action of light to sub-chloride, chlorine being set free. If no substance is present at the time of printing to absorb this chlorine it will combine with the albumenate, which is also blackened, and spots of fresh chloride will be produced which will not be of the same colour as the print. If a little free silver nitrate is left in the paper, this defect does not as a rule make its appearance.

Instead of resorting to fumigation with ammonia, a small quantity of a chlorine absorbent may be introduced into the second washing water. The sensitiveness of this paper may be increased by the application of a dilute solution of potassium nitrite and citric acid.

Paper may also be preserved from discoloration by the addition of citric acid to the sensitizing bath, or its application in any other manner to the paper. We believe that this is the method generally employed by manufacturers of sensitized paper.

From 20 to 40 grains of citric acid may be added to each ounce of the sensitizing solution, or the back of the paper may be floated, after sensitizing, on a solution of citric acid of this strength. One of the best methods with which we are acquainted, and which has the advantage of freshly-prepared paper, and at the same time avoids any great waste, is to prepare the paper without any preservatives, and to float the back of the portion not utilized for the day's printing on the citric acid solution.

Freshly-prepared paper may be kept in good condition for a few days by placing it under pressure between sheets of blotting-paper which have been impregnated with a strong solution of washing-soda and then dried.

By whatever method the paper has been prepared, it must be kept away from light, and the more entirely the access of air to it is prevented, the longer will it keep; it is, therefore, well to wrap it in tinfoil, or in an old piece of sensitized paper, film outwards, and place it in air-tight tins.

It would hardly seem necessary to point out that the paper for prints from one negative must always be cut the same way of the sheet, as a certain amount of distortion is produced by the contraction of the paper in one direction more than in the other, and if two prints from the same negative, one distorted in length the other in height, are placed side by side, the distortion will often be noticeable.

In cutting paper, the sizes of the pieces to be cut should be compared with the size of the sheet, in order to find the most economical way of dividing it up.

The exact depth to which printing should be carried can only be ascertained by practice, and depends to

some extent on the method of toning adopted, as also on the quality of the paper. With freshly-prepared paper, we have found that if a portion of the negative be picked out, such that three or four degrees only of greater transparency can be found, that the print will, in ordinary cases, be sufficiently printed when this portion just commences to bronze and the high light to take a pink tint. With many papers the loss in the subsequent operations is not so marked, the paper needs therefore a little less printing.

If the print be fixed as soon as it leaves the printing-frame, it will be of a very disagreeable red brick colour; it is therefore necessary to alter this colour or, as it is called "tone" it.

Many formulæ are in use for toning, composed of salts of gold, platinum, uranium, or lead. Gold, however, is admitted to be the most satisfactory for general purposes.

The chemical action which takes place in this process may be represented thus:—

$$AuCl_3 + 3\ Ag_2Cl = Au + 6\ AgCl$$

How this substitution comes about is not at the present time certain, but that gold is reduced has been fully ascertained. The colour of the reduced gold is blue or purple, and its power is very great, so that a small quantity is sufficient to tone a large surface. In practice, one grain of gold trichloride will tone about one sheet of paper of the ordinary size.

The first requirement of practical toning is a neutral solution of gold chloride (gold trichloride is usually spoken of as "gold chloride," or even simply "gold," by photographers). This salt is usually sold in little sealed glass tubes containing 15 grains, and is generally

slightly acid. A good plan is to place the tube, after removing the label, in an 8 oz. bottle, and shake the bottle till the tube breaks; seven and one half ounces of distilled water are added, together with a pinch of powdered chalk, which will neutralize any free acid the solution may contain.

In order that the toning action may be gradual and even, the presence of a restrainer is necessary; the exact shade produced depends also largely on the nature of this restrainer. Chloride of lime, sodium acetate, phosphate, or carbonate and borax, are a few of the substances used in practice.

We shall here describe the use of two only; formulæ for the use of some of the others will be found in Appendix A.

One of the most satisfactory restrainers, in our opinion the most satisfactory for freshly prepared paper, is sodium acetate; the bath made with this salt keeps extremely well if proper care be taken to prevent the introduction of impurities; it should have been mixed for a few days to produce the best results. The colour produced varies from brown to a rich purple black.

The prints should be well washed to get rid of the free silver before using this bath.

Distilled water	20 ounces.
Gold chloride	2 grains.
Sodium acetate	60 grains.

The above bath is probably not so good for paper containing citric acid or ready sensitized paper as the borax bath.

The colours given by this bath are very rich. The paper should not be washed in more than a couple of changes of water before toning.

A.

Borax	100 grains.
Distilled water	10 ounces.

B.

Standard gold solution (2 grs. per oz.)	½ ounce.
Distilled water	10 ounces.

Equal parts of A and B are mixed when required for use. The above quantities should tone from one to two sheets of paper, according to the colour desired.

After washing, the prints are immersed one at once into the toning solution, contained in a porcelain or glass dish, which must never be used for any other purpose; the dish is rocked and the prints frequently turned over, in order to prevent them remaining in contact with each other, and so keeping the solution from one another and causing uneven toning. When it is judged by looking *through* the print that toning has been carried sufficiently far, the prints are immersed in a dish of clean water and washed in a couple of changes; they are then fixed for from ten to fifteen minutes in—

Sodium hyposulphite	3½ to 4½ ounces.
Water	20 ounces.

to which may be added twenty or thirty drops of ammonia. The ammonia helps to prevent the albumen film blistering, and insures the absence of acid in the fixing bath.

The action of any acid is to decompose the hyposulphite of soda; this would introduce an element of uncertainty, and probably lead to stains and want of permanence in the finished print.

The dish used for fixing should never be used for any other purpose, and any proceeding which might introduce a trace even of hyposulphite into the toning bath or the washing dishes must be carefully avoided.

The fixing solution should be freshly made for each batch of prints, since, when impurities have once been introduced decomposition commences and proceeds continuously, till at length the solution becomes quite yellow or brown.

After fixing, the prints must be very thoroughly washed: if they can be placed in running water and frequently turned over for two to four hours the elimination of the hyposulphite should be practically perfect. Washing prints is always a tedious and troublesome operation. Of course in a printing establishment where many thousands have to be dealt with, special contrivances are introduced, but the amateur who has not so great a number of prints has to put up with washing under the tap or even changing his prints every few minutes from one dish to another. There is no short cut in the matter, and all we can advise is therefore, use your own common sense as to the means to be adopted, *but wash thoroughly*, or your prints will very soon show stains and spots or even fade entirely.

The enumeration of the chief defects to which prints on albumenized paper are subject, with an explanation of their causes, will assist the amateur to understand and avoid them.

Defects due to the paper or sensitizing:—

White spots with black centre appear on printing, and are caused by specks of dust on the paper during sensitizing. Each speck forms the centre round which a small air-bell forms, and thus prevents the access of the silver nitrate to the film.

Bronzed lines are often shown if there has been any stoppage in the floating of the paper. Scum on the surface of the sensitizing solution will also cause this defect, but in this case the lines are very irregular.

Insensitiveness of a large part of the sheet is often caused by excessive dryness of the paper before floating. The albumen when in this state seems to repel the solution; slightly steaming the paper before flotation will remove the cause.

Grey star-shaped markings sometimes appear when particles of lime or other inorganic matter are present in the film. They may often be detected by looking *through* the paper.

Defects due to careless manipulation:—

Refusal of the prints to tone may be caused by the presence of a minute trace of hyposulphite of soda or other impurity in the toning bath, or to the bath's poorness in the gold salt.

Unpleasant blue tones are caused by excess, and red tones by insufficient toning.

Irregular red marks in the shadows of the picture are caused by insufficient toning of these parts, owing to the presence of grease on the film, generally taken up from hot hands.

Yellowish whites in the picture may make their appearance from the use of paper which has been kept too long, from imperfect toning, fixing, or washing.

Dark mottling in the paper is caused by the acidity of the fixing solution, or by imperfect fixing in too strong a light.

Blisters are often caused by a strong solution of some of the salts used being imprisoned behind the film. They may often be avoided by the addition of a little salt to the first wash water.

This process is liable to some few other less important defects, of which the causes are obvious, and can be avoided with a small amount of care.

MATT-SURFACE PAPER.

It is sometimes desirable to obtain prints with a matt-surface, in which case the wrong side of a piece of albumenized paper may be floated on the sensitizing solution used for albumenized paper, and treated similarly. This method gives, however, very cold tones.

If a warmer tone is desirable, the back of the paper may be sponged over with a solution of citric acid in distilled water, then sensitized as above, and treated similarly to albumenized paper. The citric acid solution may conveniently be of a strength of one grain per ounce.

The above methods are useful when a small quantity of paper is required in a hurry, but are not so satisfactory as the following:—

Swell twenty grains of gelatine in cold water, and dissolve by the aid of heat, add 200 grains of ammonium chloride, and make the solution up to twenty ounces; filter the solution, and float the plain (un-albumenized) paper upon it for three minutes; dry, then sensitize, and treat as described for albumenized paper.

Prints on this paper form an excellent basis on which to colour, and are in many cases more artistic than those on albumenized paper.

CHAPTER XV.

GELATINO- AND COLLODIO-CHLORIDE.

In speaking of the albumen process, we showed that the organic silver salt formed by the combination of the albumen and silver nitrate was a necessity of the process: the limited knowledge existing with regard to the albumenate and its action, caused many experimentalists to attempt the substitution of other organic bodies; and, in 1882, Capt. Abney invented a printing process in which the albumen was replaced by gelatine. This process would be open to the same objections as that with albumen, were it not that the necessity for the presence of an organic salt is met by the introduction of a stable organic salt such as the citrate of silver, and the combination of the silver with any of the gelatine constituents is avoided by the presence of a free acid. This preparation removes the uncertainties attending the use of such little known and unstable compounds as those of silver with albumen or gelatine.

In the collodio-chloride, one of the oldest processes, the same sensitive salts are employed; and owing to the fact that no extraneous body is introduced with which silver can enter into combination, it is one of the best, if not the best process known for obtaining prints without development.

As our readers probably know, collodion consists of a solution of pyroxyline (gun-cotton) in a mixture of ether

and alcohol; on the drying of the film the solvents are evaporated, the remaining pyroxyline having little or no liability to enter into combination with soluble silver salts.

The only reason that the collodio-chloride process has remained so many years in the background has been that collodion paper is, although simple in composition, difficult and expensive to prepare with any degree of certainty. This difficulty has now been overcome by the introduction of special machinery and appliances for reducing the chances of failure and waste to a minimum, and by its manufacture on a correspondingly large scale.

To the amateur, these two processes are of inestimable value, since the papers are easily obtained in small quantities, keep well for some time, give better results than ready sensitized albumen paper, and are almost free from the element of uncertainty which is so pronounced an accompaniment of the albumen process.

Both are emulsion processes, that is to say, all the constituents of the film are mixed before application to the paper, and as their preparation on a small scale is attended with considerable trouble and difficulty, we propose only to describe their use, and advise the amateur to purchase the paper ready prepared.

These papers should, like sensitized albumen paper, be carefully kept away from light and moisture, or they rapidly deteriorate.

Negatives well suited to silver printing also give the finest results with these papers, but thin negatives will yield better results with either gelatino- or collodio-chloride than with albumenized paper.

Gelatino-chloride paper may also be used for rapid printing. We, however, defer to a subsequent chapter

a description of its development and general treatment for this purpose.

GELATINO-CHLORIDE.

Gelatino-chloride is printed in the same manner as albumenized paper, but printing should be carried very little deeper than desired in the finished print, as there is little loss in toning and fixing. Matt surface paper must be printed to a somewhat greater apparent depth than the glossy variety.

It is important that the paper should be kept dry during printing; an indiarubber pad may be used, as recommended for platinotype.

The idea that the time elapsing between printing and toning is of no importance is very prevalent, but our experience has led us to the conclusion that the sooner toning takes place the better will be the results.

Before toning, the soluble salts and acid contained in the paper must be washed out, and the more rapidly and thoroughly this washing is carried out the better. Three changes of water in which the prints are kept moving, and a good douche under the tap will be found satisfactory.

After this washing it is desirable, but not essential, to convert the organic silver-salt, which the paper contains, into the chloride or bromide. The reason for this conversion being that if it remains in the paper, a portion of the gold trichloride of the toning-bath will be decomposed, giving up chlorine to the organic salts and converting it into chloride, thus rendering the liberated gold inert. An organic acid is also formed in the bath by this mutual decomposition, which has a powerful reducing action on the "gold" salt. If the organic

salt be found unconverted, a large portion, therefore, of the gold of the toning-bath will be wasted.

Another advantage of this conversion is that the prints tone more evenly; and the colour of the print is also liable to less change in the fixing solution, so that it can be judged with greater exactitude.

In order to carry out the conversion, the prints are immersed for from 5-10 minutes in a dilute solution—one ounce to the pint of water answers well—of common salt or potassium bromide. After the application of this solution, the prints are washed for about five minutes to remove the excess of salt, which would otherwise cause uneven toning.

When the above method is adopted, any of the toning-baths suitable for albumen paper may be employed, but the strength should never be less than two grains of "gold" per pint. It is better to use a fresh bath for each batch of prints, and, in fact, with many toning-baths this is essential.

The following toning-bath has been specially recommended for this paper:—

Ammonium sulphocyanide . . .	12 grains.
Gold trichloride	1 grain.
Water	10 ounces.

The quantity of toning solution may be regulated by the number of prints to be toned at one time, and by the quantity of "gold" which it contains: such a quantity of solution as will contain two grains of gold will satisfactorily tone one sheet, or perhaps rather more. The prints should all be toned at the same time, since if one is first toned, then another, they will differ in quality, owing to the weakening of the bath.

After toning, the prints are washed in two or three

changes of water, and fixed in a fresh 10 per cent. solution of sodium hyposulphite for from ten to fifteen minutes.

Prints, on this paper especially, should not be *soaked* to get rid of the hypo, but should be washed as rapidly as possible by being placed in running water and kept in constant movement. The prints are heavier than either albumen or collodion prints, and have a strong tendency to sink to the bottom of the washing-vessel in a compact mass. A good method of avoiding this is to use a trough with a double bottom, the upper of which is perforated; the water entering below the perforated bottom rises under the prints, preventing them sinking, and keeping them in constant motion.

After washing for from one to two hours, the prints should be immersed in a 10 per cent. alum solution, to harden the film. Five minutes in the bath suffices. They are then washed for ten minutes in running water.

The tones obtained by the above method all have a tendency to coldness, and if warm tones of great richness are desired, a combined bath, one containing the elements of both a toning and of a fixing solution, should be adopted.

The following method has also the advantage tha since the prints are fixed before toning, the alteration of colour during fixation, which occurs in the previous method, need not be allowed for in toning.

Prints must be printed much more deeply when it is intended to fix them previous to toning, than otherwise.

When printed sufficiently, the prints are washed, salted or bromized, and again washed, exactly as above described; but instead of being then toned, they are placed in the fixing-bath (prepared as above) for ten or

fifteen minutes, and are then washed for five minutes in two or three changes of water.

The toning solution which we ourselves use, and which we can strongly recommend, is one published by the Eastman Company, and is as follows:—

A.	Hyposulphite of Soda	4 ozs.	These solutions are made and mixed, when a precipitate will form, which must be allowed to settle or filtered out.
	Alum	3 „	
	Hot water	40 „	
	Borax	1 „	
	Hot water	4 „	
B.	Gold chloride	7 grains	Dissolve the lead in part of the water and add the gold. A heavy precipitate forms which will re-dissolve in solution A.
	Lead acetate	30 „	
	Distilled water	4 ozs.	

If the gold solution (2 grs. per oz.) advised in the previous chapter has been adopted, this solution will be made as follows:—

Lead acetate	30 grains.	To which must be added 3½ ozs. of gold solution.
Distilled water	½ ounce.	

For use take of solution A . . . 8 parts.
B . . . 1 part.

Solution B. must not be filtered, and must be shaken up in order to get the proper proportion of precipitate when mixing with solution A.

The prints are then toned to the desired colour, remembering always that they appear somewhat warmer in tone wet than dry.

When toned, wash the prints as described in the first modification of the process, then dry or mount wet. The separate alum bath is unnecessary.

COLLODIO-CHLORIDE.

The manipulations required in printing collodio-chloride paper resemble those employed for gelatine

papers so closely that it will only be necessary to describe the points of variance.

The preliminary washing of these prints is best conducted in hot water, as the prints have then less tendency to curl.

A porcelain dish is filled to the depth of an inch with water as hot as the hand can comfortably bear, each print is immersed face downwards and pressed at once on to the bottom of the dish, after a quarter or half a minute the water is poured off, the prints lifted out, the dish re-filled with hot water as before, and the prints again laid in the dish one at a time face downwards. This water is poured off in about a minute, and the prints well rinsed in cold water.

The prints are salted, washed, toned, rinsed, fixed, and finally well washed, as described in the first modification of the gelatino-chloride process. The alum bath is, of course, not required.

The toning baths recommended for gelatine and albumen paper are equally suited to this process. The phosphate bath (Appendix A) gives a peculiarly rich purple tone which some amateurs greatly admire.

There are numerous modifications in the details of the above processes, many of them strongly advocated by manufacturers of excellent papers, but we have limited our description to those methods which we have ourselves employed with success.

CHAPTER XVI.

CARBON.

THE carbon process, as we have already explained, depends on the fact that gelatine and bichromate of potash combine under the influence of light to form a compound which is insoluble in hot water. It is easy to realize that if some colouring matter, such as Indian ink, is mixed with the gelatine, a print may be produced by coating a sheet of paper with the mixture, exposing under a negative, and then dissolving away with hot water those portions of the gelatine which remain soluble, the colouring matter being washed away at the same time.

Printing in carbon is an operation which depends for its success entirely upon the care and dexterity displayed in its different processes; it is very simple, and when properly carried out, the results are extremely satisfactory and permanent. It usually finds little favour with amateurs, because there is no margin for careless and slovenly work; absolute accuracy is essential, and the slightest carelessness in any portion of the process is productive of utter failure.

Sensitive carbon tissue has about double the sensitiveness of albumenized paper of good quality, and if light and air be excluded from it, will keep for at least a week.

Having been cut to the required size, the tissue is sensitized as follows:—

Pour into a wide tin dish sufficient solution of bichromate of potash in water (1 ounce bichromate to 20 ounces water), immerse the tissue face downwards for three minutes. Air-bubbles may be avoided by holding the tissue by opposite corners and sliding it into the solution; it may then be lifted and swept with a broad camel-hair brush, to remove any minute bubbles which may have been formed, and to remove also any impurity which may be found on the surface.

When sensitized, lift the tissue out carefully, lay it face downwards upon a clean sheet of glass, and then squeeze or blot all the surplus solution from the back, so as to leave it surface dry. Raise it and lay face upwards upon blotting-boards to dry. Drying must, of course, take place in the dark room. If the tissue be sensitized at night, it should be dry and ready for use by the morning. The only certain way of testing the sensitiveness of the tissue, which varies greatly, is by experiment.

Printing is carried out in the ordinary way, but an actinometer must be used to determine the exposure. Previous to putting it in the printing-frame, the negative should have a border of black varnish run round the edges, to form a "safe edge," and prevent the tissue tearing up during development; a black paper mask may also be used for the same purpose. The varnish may be put on the glass side, so as to be easily removable, as it may happen that another print may be required from the same negative by a different process.

When sufficiently printed, take the tissue out of the frame and immerse it in cold water, where it will begin to curl inwards, owing to the fact that the gelatine is upon a paper support which will expand more quickly than the film. It will, however, rapidly uncurl itself

and straighten out. Leave it in the cold water a few minutes, then lay it face down on the final support which has been laid in the dish, while still in the water, bringing them both out together. Squeegee the print down with considerable force in order to obtain perfect contact, and lay it between blotting-boards for about twenty minutes.

The print may then be placed in water heated to a temperature of about 110° Fahr. to soften the gelatine, and as soon as the edges of the gelatine appear to squeeze out it may be considered that the original paper is sufficiently loosened. Strip the paper off, wash the black mass of tissue by dashing warm water on to it, gently at first, but after the image has appeared more vigorously, or apply by means of a soft sponge: the soluble portion of the tissue, that which has not been influenced by the light, will thus be got rid of, leaving the insoluble portion which will constitute the picture.

Wash the print in cold water and then place it in a dish containing a 5 per cent. solution of alum, to harden, wash it in cold water and allow it to dry; the result will be a reversed positive print. If it is a profile of a head turned to the right, for example, it will in the print be turned to the left, for reasons which are sufficiently obvious.

This is called the "single transfer process," if it is necessary that the image be not reversed, so that the same position is obtained as in a silver print, another operation must be performed; instead of the tissue, which is soaking in the cold water, being brought into contact with the final support, it must be placed in contact with a zinc plate or piece of thick paper which is coated with a solution of virgin wax dissolved in turpentine. This is called the temporary support, and is subsequently removed.

A direct or non-reversed print may also be obtained by the single transfer method if a reversed negative be employed. With film negatives in which the support is very thin, printing on to the tissue may take place from the back of the negative. The film may also be stripped from a glass negative and then printed from the wrong side.

If a negative be placed for a few minutes in a dilute solution of hydrofluoric acid, the film is loosened from the glass and may then be printed from the wrong side. A better method of stripping the film, since it at the same time strengthens it, is to coat it with dilute gum-arabic solution, and after gumming strips of paper round the edge and drying, to coat with—gelatine, 100 parts; water, 400 parts; glycerine, 15 parts, and alcohol, 100 parts. This is allowed to set, and the negative placed on edge to dry. When dry, the plate is coated with collodion and allowed to remain in a damp room for three or four hours, a knife run round the edge of the picture will then loosen the film.

In the double transfer process, development and finishing take place in the manner previously described for single transfer. When the print, attached to the temporary support, is dry, it may be transferred to the paper or other material forming the final support; this should be coated with a weak solution of gelatine dissolved in water (about 5%) with enough bichromate of potash added to colour the solution a very pale sherry colour. The support thus coated should be exposed to the light and allowed to dry before use.

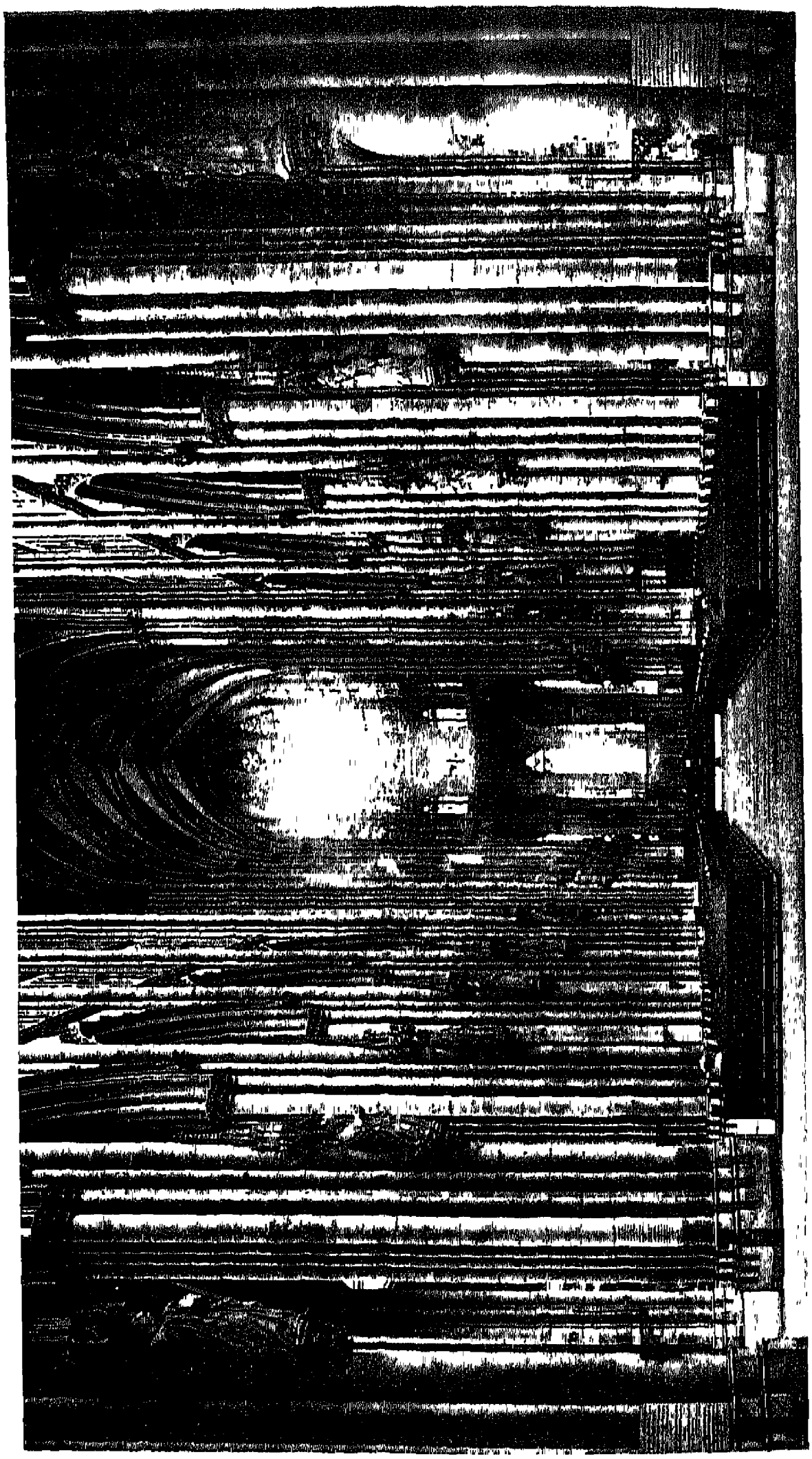
The tissue can be transferred to its final support immediately after the final rinsing in cold water, but this is a somewhat delicate operation, and if time is of no object it is better to allow it to dry.

The final support should be larger than the print, but

smaller than the temporary support, and should be softened in cold water for half an hour before use.

Place the dried print in clean water heated to 120° Fahr., and at the same time introduce the support, bring them carefully together, avoiding air-bubbles, lift both out together, squeegee them to expel any water, and lay them to dry between blotting boards. When quite dry, the temporary support will peel off, leaving the print in the required position. This is known as the double transfer process.

The principal points to be attended to in carbon printing, are: avoid handling the face of the tissue; when sensitizing be certain there are no air-bubbles; do not keep the sensitized tissue any longer than can be avoided, as it hardens, becoming horny and insoluble; let every article used be perfectly clean; be sure that the temporary support is well coated with the waxing solution, and with nothing else; avoid finger-marks, and do not attempt to hurry through any of the different parts of the process. The process is somewhat troublesome, but well repays the necessary care and attention. A good carbon print is, in our opinion, the one form of photographic print which is best suited to the greatest variety of subjects, and from which the most artistic effects may be expected; it is specially adapted to enlarged work, and for life-sized enlargements of portraits is capable of the most artistic finish.



IMITATION PLATINOTYPE.

PLATE XXVII. (*Collotype.*) [Face page 187

CHAPTER XVII.

PLATINOTYPE.

PLATINOTYPE papers may be divided into two classes, true printing-out papers, such as that invented by Captain Pizzighelli, and those which cannot be correctly described either as printing-out papers or classed with the rapid printing papers.

The papers of the second class are in most common use; in this country their manufacture is in the hands of the Platinotype Company, and is carried out by a patented process, the invention of Mr. W. Willis.

We have already alluded to the chemical reactions taking place in the printing of these papers.

They must be preserved in a dry atmosphere, as the slightest dampness will entirely spoil them. In order that the papers may not be attacked by moisture whilst in the printing frame, it is essential that a thin sheet of indiarubber or other damp-proof material be placed between the paper and the pads.

The papers manufactured by the Platinotype Company will keep in good condition for at least two months if care is taken that all moisture is excluded from them. The best means of securing this absence of moisture is by keeping the paper rolled up in a tin tube provided at one end with some means of holding a supply of dry calcium chloride, and from which air is excluded as far as possible by placing a wide rubber

band over the junction of lid and body. Calcium chloride is employed on account of its great affinity for water, which it extracts from the air and itself gradually deliquesces. As soon as it becomes moist and soft to the touch, it should be replaced by a fresh supply; the moisture may then be driven off by heating the portion which has been in use to redness on a shovel.

The great drawback to these papers is that much experience is required to determine when they are sufficiently printed, since the image is of a delicate greenish grey or brown colour, on the yellow ground of the paper.

Since these papers are about three times as sensitive as albumen papers, less light must be employed for examination, or degradation of the whites, only visible after development, will result.

Printing should be carried on in the same manner as for the papers already described, the completion of the operation being determined by the visibility of all detail except that in the high lights. If the paper has been slightly damp, the image will be less visible than with dry paper. After printing, the same precautions must be taken as before to avoid the access of moisture.

Development takes place by floating the paper upon a solution of potassium oxalate in a feeble white light, or by gas-light. In what is known as the "hot-bath" process the developer (potassium oxalate 6 oz., water 20 oz.), is heated to a temperature of from 120° to 150° Fahr. in an enamelled iron or other dish. The prints when taken from the frame should be rolled with the sensitized surface outwards, in order to acquire a curl in this direction.

One end of the print is taken in the hand, and the other end placed upon the developing solution, the

print is pushed slowly across the dish, the hand at the same time being lowered, so that the whole surface comes evenly into contact with the developer. The print may then be lifted, and after breaking any air-bubbles, replaced on the solution.

The tone of the print and the time required for development depend upon the temperature; the hotter the bath, the warmer the tones, and the quicker the development of the print.

If the same developing solution be used repeatedly, it will become charged with salts from the paper, and the quality of the prints will deteriorate. Our practice is to throw away a small portion of the developer, after use for each batch of prints—5 per cent. is a suitable proportion. The remainder of the developer is returned to the bottle unfiltered, and kept away from strong light. The solution, which will have become turbid during development, will rapidly become clear, although remaining of a yellowish colour. The clear solution is then taken, and a quantity of fresh developer from the stock bottle, equal to the quantity of old developer discarded, is added. By this method the solution is kept in good order, and the resulting prints are even in quality.

Prints slightly over or under exposed may often be satisfactorily developed on a colder or hotter solution.

After development it is necessary to dissolve out the salts which have been unacted upon by light with hydrochloric or citric acid, removing at the same time the yellow colour from the lights of the paper. The prints, on removal from the developer, are placed face downwards in a dilute solution of pure hydrochloric acid. If the specific gravity of the acid be not less than 1.16,

a solution of 1 part in 60 parts of water works well. With a weaker acid a larger proportion is required. It is not advisable to use the acid of greater strength than this, owing to its action in rotting the paper, although it would have no action on the actual image. A white opalescence of the acid bath indicates the need of a stronger solution.

The prints should remain in this bath for about five minutes, then be transferred to a fresh acid bath for about ten minutes, and again to a third for a quarter of an hour. This usually suffices, but should the third bath not remain free from the slightest trace of yellow colour a fourth must be used. The acid baths must not be used a second time.

The prints may now be washed for a quarter of an hour, either in running water, or in three or four changes, to one of which a pinch of washing soda has been added, to neutralize any acid which might otherwise remain in the paper.

Sepia paper.

A modified platinum paper is now prepared, which gives sepia tones. It is supposed that this difference in colour is caused by the use of a mercury salt in conjunction with the platinum.

This paper is more sensitive to weak light than the black variety, and must therefore be handled with greater care; its sensitiveness also continues after development, in fact, until complete fixation; so that, unlike the "black" paper, it cannot be fixed in a strong light.

The development takes place on a solution of potassium oxalate of the usual strength to which has been added from 12 to 20 per cent. of a special solution sup-

plied by the Company. A half spent "black" bath appears to work well with the addition of the sepia solution.

These prints must be kept separate from those of the black variety throughout all the operations; dishes or solution once used for developing sepia must not be used for "black" paper.

The sepia developing bath must always be kept in darkness, and may be maintained in good order by rejecting a small portion after the development of each batch of prints, as in the previous modification.

Cold development.

Paper of the "black" variety is also prepared suitable for development on a cold solution. The developer is more dilute and the action slower.

A rather full exposure under the negative must be given, and the prints developed on a solution similar to the hot bath, with the addition of twice its bulk of water. The tone may be somewhat varied by rendering the developer *very slightly* acid for cold or alkaline for warm tones.

Under-exposed prints may be developed at a temperature of 80° or 100° F.

One of the greatest advantages of this process is, that by the use of glycerine, brush development may be resorted to; a good proportion of glycerine is ½ oz. to 1 oz. of developer.

It is unnecessary to further describe the method of brush development, since the subject has been fully treated in a previous Chapter (IV).

Mr. Willis has also invented another interesting process suitable to cold development. The platinum salt

is here used in the developer instead of being incorporated in the paper.

Printing-out Platinotype.

The printing-out platinum process, invented by Captain Pizzighelli, resembles closely that of Mr. Willis, with the exception that the developer is incorporated with the paper, and development takes place by the aid of atmospheric influences during printing.

All the precautions above described must be adopted with this paper to avoid moisture until the paper is placed under the negative, when it must not be kept absolutely dry or it will refuse to print with any degree of facility.

The after treatment of the paper consists in washing first in dilute acid, then in clear water, as in the other processes.

We have used this paper somewhat largely, but have not found that the commercial samples we have been able to obtain have been entirely satisfactory, nor have their keeping qualities been good.

It is not advisable to keep this paper longer than a few weeks.

We have prepared this modification with good results, by a slight alteration of the method described by Gunther; but as we do not at present feel confident that our method would be successful in other hands, or that it is any improvement on the process mentioned, we refrain from describing it.

The following method of preparation of printing-out platinum is extracted from another work.[1]

[1] "Instruction in Photography," Capt. Abney.

Sensitizing the paper:—

For coating, Rives or Saxe paper may be used, either glossy or with a matt surface.

Solutions of gum-arabic and of arrowroot have been found the best vehicular substances for the sensitizing liquid, but the former has proved to give better results than the latter.

Gum-arabic	50 c.c.
Distilled water	100 c.c.

Before use mix :—

Sensitizing liquid	2 parts
Gum solution	1 part

The mixture is well stirred, until it forms an entirely homogeneous liquid, and is then filtered through muslin.

Preparation of ferric oxalate for platinotype.

For the preparation of this solution of ferric oxalate the following operations are necessary :—

(1) Manufacturing the ferric hydrate ; (2) dissolving that substance in oxalic acid ; (3) determining the amount of iron and of oxalic acid contained in this solution ; (4) diluting and acidulating the same.

The method of preparing ferric hydrate is generally well known, but for the sake of completeness we will give a brief description of it. Ferric chloride, 500 grains, are dissolved in from 12 to 13 ounces of water, and when the solution has been brought to the boiling point, solution of soda is added until it gives with litmus paper a distinctly alkaline reaction ; for this purpose about 250 grains of caustic soda will be found necessary. The precipitate is then washed with hot water by decantation, until the wash-water is no

longer alkaline. It is next placed in a cloth and, by pressure, freed from the greater part of the water. With the ferric hydrate thus obtained, which ought to have a syrupy consistency, there should be mixed about 200 grains of finely-crystallized oxalic acid, and the mixture be then left to itself for a few days, at a temperature of not more than 30° C., and in a place completely protected from the light. Under these circumstances, the formation of ferric oxalate will go on steadily. Some persons recommend the promotion of this process by digesting the mixture for some time at a high temperature; this we are decidedly opposed to, since by heating for even a few hours to 50° or 60° C. the salt will be partially reduced to ferrous oxalate. At the commencement the solution has a pure green colour; by continued cooking it turns yellowish green, and finally greenish brown. When this moment has arrived, the remaining ferric hydrate should be filtered off, and the solution submitted to a quantitative chemical analysis. The amount of iron can be ascertained by evaporating an ounce, heating to redness, incinerating with nitrate of ammonia, and weighing the ferrous oxide which remains.

From the analysis, we ascertain the quantity of ferric oxalate contained in an ounce of the solution, as well as any slight excess of oxalic acid which happens to be present. The liquid is then diluted with so much distilled water that every ounce of it may contain 100 grains of ferric oxalate, $Fe_2 (C_2O_4)_3$. Crystallized oxalic acid is then added until, with the free acid already in the mixture, that substance amounts to from six to eight per cent. of the ferric oxalate already in the solution.

The sensitizing solution is prepared as follows:—

To the normal ferric-oxalate solution is added—in the dark room, and keeping the dish rocking—as much of neutral ammonium or sodium oxalate as will just dissolve at the ordinary temperature. For this purpose will be required of the above-named salts :—

To normal ferric-oxalate solution . .	100 c.c.
Neutral ammonium oxalate . . .	18 to 20 grammes
Or, to normal ferric-oxalate solution .	100 c.c.
Neutral sodium oxalate	15 to 18 grammes.

By formation of the corresponding double salt, the brownish-grey colour of the ferric oxalate changes to a beautiful emerald green. If the solution begins slightly to darken, this will indicate that the saturation is completed. As soon as this takes place, no more ammonium or sodium oxalate should be added; keep the dish rocking for some further time, allow to set, and then filter.

The solution may be mixed as follows :—

Chloro-platinite of potassium solution—	
1 part to 6 parts of water . . .	24 c.c.
Ammonium-ferric oxalate solution or	
sodium-ferric oxalate solution . .	22 „
Gum solution	23 „

If ammonium oxalate be added, the prints will be of a more bluish tone; whilst, by the addition of sodium oxalate, they are rendered more brownish. The former gives somewhat softer prints than the latter. As to the sensitiveness, there has been found no marked difference between the two salts.

The coating must take place in very feeble light. Yellow light is the best, but it is hard to see the colour of the solution. Suppose it be wished to sensitize a surface of paper measuring 8 by 10, or 12 by 15, the

simplest method is to place a piece of paper of sufficient size, with its prepared surface uppermost, upon an 8 by 10 or 15 by 12 glass plate, and then to fold the edges of the paper underneath the plate. By placing the plate upon a table (or, better, on a glass plate of larger size), the edges of the paper will be securely held between the plate and the table, and a smooth surface will be secured. The paper must be larger than the plate, to allow its edges to be turned over. Another method of securing a smooth surface is to place the paper on a glass plate of the same dimensions as the paper, and then to clip together the corner of the plate and the paper by means of American clips. Yet another method, which frequently answers well, is to pin the paper by its corners to the smooth surface of a deal board.

The sensitizer is now applied to the surface by means of a pad of cotton-wool, or better, by a pad made by enclosing a tuft of cotton-wool in a small piece of flannel or old gauze under-clothing.

To coat a surface measuring 8 by 10, from 25 to 30 minims of sensitizer will be required. This quantity should be measured, and then poured on the middle of the sheet of paper, and immediately spread over the surface with a circular motion, in as even a manner as possible, by means of the above-described pad. The rubbing should be very gentle, and should be continued until the coating becomes as uniform as possible.

Drying the paper :—

Success much depends on the care with which this operation is performed; the instructions here given should be strictly adhered to.

As soon as the sheet has been coated, it should be hung up by one or two of its corners (on no account

should it be laid over a rod) until the surface-moisture has disappeared. Directly this has taken place, the sensitized surface should be dried before a fire or stove, or over a gas-burner. It is of the utmost importance that the paper be *perfectly* dried. The completion of the drying is indicated by the change in colour of the surface, which changes from lemon to orange-yellow, and by the crackling sound of the paper. Great care should be taken not to scorch the surface. A scorched sensitive surface gives grey, fogged prints.

It is important to allow a sufficient, but not too long, time to elapse between the coating operation and that of drying. Not less than five nor more than ten minutes should be allowed to elapse between these operations. If paper be dried too soon, too large a portion of the platinum image will wash off in the developer. If not dried quickly enough, the print will be sunken in and flat.

In very dry weather, particularly in some climates, the surface-moisture will disappear too rapidly—that is, in less than five minutes; in such a case, the atmosphere of the room in which the paper is hung up should be moistened by sprinkling the floor or walls with water, or the paper may be placed in a damping-box or cupboard.

CHAPTER XVIII.

RAPID PRINTING AND ENLARGING.

In all the printing processes, with one exception, described in the previous chapters, it is possible to judge of the depth of printing by looking at the print, but in the case of bromide, and in some other processes, this is impossible, and the correct exposure of the paper under any particular negative must be estimated, or be determined by making trial prints from portions of the negative on small pieces of paper.

The rapidity with which prints may be obtained on bromide paper, and the fact that there is complete independence of the weather, has gained for this paper a spurious popularity. The prints are not so beautiful as those in platinotype or carbon, but the ease and rapidity with which they can be produced in the evening render the process a very desirable one for the amateur.

There are in the market very many brands of paper of excellent quality, and also several brands where the surface or the colour varies considerably from the standard.

The manipulations required in printing on bromide paper very closely resemble those employed for the production of negatives.

As in other processes, the first step towards success must be made by judging from the character of the

negative whether a strong or weak light will yield the best print. The use of any light so intense as direct sunlight, is of course, practically impossible, but a large range of variable light intensities is still available. The strongest light ordinarily used is diffused daylight, and even with this light it is difficult to give a sufficiently short exposure, unless the negative be extremely dense, or be somewhat fogged. The weakest light used is that of an ordinary candle some six feet distant from the printing frame.

Before entering into the practical details of the process we may say that the best prints are obtained from negatives full of detail, but somewhat too thin to yield satisfactory prints on albumenized paper, and that fair prints can be obtained from negatives which are useless for the printing-out processes. The exposure requisite for a bromide print is determined by the consideration of the strength of the light employed, the rapidity of the paper, the opacity and general character of the negative, and the character of the print it is desired to produce.

The rapidity of the paper is usually stated by the makers, or rather the correct exposure under a negative of average opacity, placed a certain distance from an ordinary gas-flame or candle, is stated.

If the contrasts in the negative are too strong, a somewhat long exposure should be given, and the development should not be carried too far; if, on the other hand, the negative is flat, or lacking in contrast, a short exposure will give the best result if the development is pushed as far as possible.

Bromide paper is as a rule developed with ferrous oxalate, prepared at the time of development by mixing a solution of potassium oxalate with one of ferrous sulphate. The greater the proportion of iron salt introduced into

the mixture, and the greater the quantity of restrainer, the greater will be the contrast resulting in the print, and the more "black and white" character it will have.

Metol, one of the more recent developers, has been used for this paper with much success. It works very cleanly, and produces a more "black and white" print than the iron developer, which gives always a greyish tendency. Amidol is also, we believe, well suited to this process, but we have had little experience of its employment.

It is somewhat difficult to vignette well on bromide paper. Probably the best way is to expose to the light of a candle, at least three feet away from the frame, taking care that the candle is opposite the centre of the negative, and that the frame is placed "square" to the light; a card with a hole of the required shape cut in it is held a little distance from the frame, and moved backwards and forwards, i.e., nearer to and further from the candle, during exposure. The distance of the card from the negative, and the amount of movement given, must of course be regulated by the amount of vignetting to be produced.

A negative may be sometimes improved by the use of a transparency, as explained in Chapter XIII., but for this purpose the transparency must be produced by exposure to a candle or other flame placed at a considerable distance from the negative; printing must be done in the same way. If this precaution were not taken, a worthless result would probably be obtained; for instance, if the glass of the negative were at all thick, and the transparency were produced by exposure to a candle-flame at a distance of six or eight inches, the light would penetrate behind the edges of the shadows in the negative, and when the negative was printed, the

edges of those portions adjoining the shadows would be too much protected by the transparency, and the nearer the source of light in printing, the more marked would be this defect.

It is essential that some acid should be used in developing bromide prints by ferrous oxalate, to prevent the iron salt being absorbed by the paper, as would be the case if the print were immersed in water immediately on its removal from the developer. This acid solution is known as the clearing solution.

Bromide paper is often extremely useful for rapidly getting a proof of a negative. A print may be obtained from the negative as soon as it is rinsed after fixing; the negative is laid face up in a dish of clean water, and a piece of bromide paper, at least as large as the negative, which has been previously soaked for a few minutes in water, is laid face down on the negative, which is then raised out of the dish with the paper upon it; the paper is squeegeed down on to the surface of the negative to avoid air-bubbles, and is then exposed in the printing frame, as in the production of an ordinary bromide print. The exposure will require to be slightly longer than with dry paper under the same negative. The reason that the paper must be at least as large as the negative, is simply that were it not so the edges of the paper would damage or even cut through the film.

On removing the print from the frame, it is soaked in water for about a minute, whilst the developer is mixed; the following is a good formula:

A

Neutral potassium oxalate	8 oz.
Ammonium bromide	10 grs.
Water	32 ozs.

B

Ferrous sulphate	8 ozs.
Sulphuric acid	30 minims.
Water	24 ozs.

For use, add one part of solution B to six parts of solution A. If solution A be added to B, a heavy precipitate will form.

Potassium bromide solution is used as in developing negatives. A little old developer is a desirable addition in cases of over-exposed prints.

Development very closely resembles that of negatives by the ferrous oxalate method, and needs no further description.

As soon as development is complete, the print is thrown face down into a solution of acetic or citric acid, in order that the iron of the developer which precipitates may not become imbedded in the film, and so destroy the purity of the whites. It is often advisable to use a second clearing solution:

Acetic acid	1 drachm.
Water	32 ounces.

After clearing, the prints must be washed in three or four changes of water, to free them from all traces of acid, and then placed in hyposulphite solution (one to five) to fix.

When completely fixed, bromide prints must be very thoroughly washed, as, if any of the fixing agent remain in the film the whites of the paper will in time discolour.

A defect due to imperfect fixation may here be pointed out. Large stains sometimes appear during washing, and become more pronounced on drying the prints; these stains are yellowish or brownish-grey patches, and are caused by prints sticking together, or floating on the surface whilst in the fixing solution, which has

not, therefore, sufficiently acted on these parts. The remedy is obvious.

If it is desired to preserve unmounted bromide prints in a flexible condition, for book illustration or other purposes, glycerine may be added to the last washing water.

There are several rapid printing papers in the market which much resemble the bromide papers in manipulation, but differ in colour and other particulars.

Among these papers we consider that the ordinary gelatino-chloride paper previously described must find a place, as although, like platinotype, it is neither a true development paper, such as the bromide, nor a true printing-out paper, it combines to a large extent the qualities of both, and the results obtained are even more beautiful when development is employed than when completely printed-out. We believe that the success of this method is due to one of the experimenters of the Paget Prize Plate Company.

The gelatino-chloride paper requires printing, when development is to be resorted to, for from one-twentieth to one-fifth the time required to print-out completely; one-tenth is a good average. The print should just show the whole, or almost the whole, of the detail; it should then be washed, bromized, and again washed, as described in Chapter XV.

The prints are then immersed in the developer until sufficient strength has been obtained. They are then well washed, toned, fixed, and finished, exactly as described for printed-out prints.

The developer is as follows:—

Hydrochinone . . .	½ oz.	A
Sodium sulphite . .	½ oz.	
Sulphurous acid . .	½ oz.	
Water, to make . .	20 oz.	

Ammonia ·880 .	1½ drachms	B
Potassium bromide .	. 1¼ oz.	
Water . . .	. 20 oz.	

NOTE.—Sodium-carbonate, 1 oz., may be substituted for the 1½ drachms of ammonia.

In this case, as in that of negative developers, we have the developer proper, hydrochinone; the accelerator, alkali; and the restrainer, bromide. The character of the print depends upon the proportions of these agents to the total quantity of solution.

Variation of the alkali simply increases or diminishes the time required for development.

The variation of the quantity of bromide, within certain limits, does not appear to have any effect on the development.

The strength of the hydrochinone, however, is of extreme importance, since a hard or soft print will result from a negative according as the proportion of hydrochinone is smaller or greater.

A good average solution is made by taking one part each of A and B, and adding one part of water.

There is a great tendency to develop too far at first, owing to the feeble colour of the image. Development should cease as soon as the finest details are almost out. To stop development, plunge the print into clean water and then into a bromide bath similar to that previously used. After soaking in this bath for two or three minutes the print is washed for ten minutes, and then toned and finished exactly as described in Chapter XV. for those which have been printed-out.

Prints may also be developed without the use of the bromide bath. The Eastman Company's formulæ are,—

A

Hydrochinone	½ ounce.
Sulphite of soda	½ „
Potassium bromide	1 „
Ammonium bromide	2 „
Water	64 „

B

Caustic soda	½ ounce.
Water	16 „

C

Tannic acid	8 grains.
Water	1 ounce.

To develop, take—

A	5 ounces.
B	1 „
C	1 dram.

After development, immerse in acetic acid solution (three drachms per gallon), wash and tone as before.

ENLARGING.

There are numerous methods of producing enlargements, and also many various arrangements of the enlarging apparatus.

Where great quantities of enlargements have to be made, a specially constructed camera is usually employed. A camera such as this is, however, large and unwieldy, and occupies so great an amount of space that it is a possibility for very few amateurs.

Probably the best arrangement which the amateur can employ—unless it is only intended to enlarge from 4¼ × 3¼ or from 5 × 4 negatives—is to have a box so fitted to the dark-room window that the negative to be enlarged can be slipped in close to the window. At the inner end a bellows and tailboard are so arranged as to carry a short focus rectilinear. A vertical easel is arranged to slide in two grooves in the floor, and

to this easel is attached the paper on which the enlargement is to be made.

Outside the dark-room window a mirror about twice as long and somewhat wider than the largest negative to be enlarged is hinged, so that light falling on it from the sky can be reflected through the negative. The focussing and arranging of the picture may be carried out on the sensitive paper itself if an orange coloured screen be put against the lens, or a separate piece of paper may be used, the lens capped, the sensitive paper substituted, and the exposure made.

This method is, of course, only applicable to daylight work. When enlargements have to be made by artificial light, more complicated arrangements must be resorted to, since it is important that parallel rays should be used. The negative may be illuminated by the rays of a powerful lamp reflected from a sheet of white paper, or, if the electric light is available, a number of incandescent lamps may be fixed to the bottom of a shallow box, covered with a piece of rough ground-glass. This light must, of course, be so screened as to fall upon the negative only.

Where large quantities of enlargements have to be made by artificial light, a specially constructed lamp with a large condenser is used, but such condensers are too expensive for employment in other cases. Where it is desired to vary the light on various parts of the negative, a piece of burning magnesium wire may be used as the illuminant, and constantly moved about.

The most convenient method of enlarging small negatives, such as quarter-plate and 5 × 4, is to use an ordinary optical or magic lantern, with a condenser somewhat larger in diameter than the diagonal of the plate. The negative to be enlarged is fixed in a carrier,

and takes the place of the ordinary slide, any rectilinear or portrait lens being used to project its image on to the sensitive paper.

The size of the enlargement is regulated by the distance between the easel and the lens; the distance between the negative and the lens will also vary. In order to facilitate the necessary adjustment of the apparatus we give the following table:—

Focus of Lens, inches	TIMES OF ENLARGEMENT OR REDUCTION. 1 inches	2 inches	3 inches	4 inches	5 inches	6 inches	7 inches	8 inches	
2	4 4	6 3	8 2⅔	10 2½	12 2⅖	14 2⅓	16 2⅐	18 2¼	
3	6 6	9 4½	12 4	15 3¾	18 3⅗	21 3½	24 3⅜	27 3⅜	
4	8 8	12 6	16 5⅓	20 5	24 4⅘	28 4⅔	32 4½	36 4½	
5	10 10	15 7½	20 6⅔	25 6¼	30 6	35 5⅚	40 5⅝	45 5⅝	
6	12 12	18 9	24 8	30 7½	36 7⅕	42 7	48 6⅞	54 6¾	
8	16 16	24 12	32 10⅔	40 10	48 9⅗	56 9⅓	64 9⅐	72 9	
Approx. exposure required	1 1	·56 2¼	·45 4	·39 6¼	·36 9	·34 12¼	·33 16	·31 20¼	for reduction for enlargement.

The distances given show the distance of the sensitive plate, and of the negative to be enlarged, from the optical centre of the lens. For enlargement, the

greater distance is that of the sensitive plate or paper from the lens; for reduction, the greater distance is that of the negative to be reduced from the lens.

The exposures given are compared with that required, when copying the same size as original, with the same size of stop and the same light.

The greater the degree of enlargement the greater will be the area over which the light is spread, consequently the longer the exposure required.

The treatment of the paper after exposure is exactly similar to that described in the earlier portion of this chapter.

A few hints with regard to copying may not be out of place. Monochrome drawings should be lighted as nearly normally to the surface as the position of the apparatus will allow, in order that the grain of the paper may be hidden as much as possible. Wash drawings are generally of a rather non-actinic character, and should therefore be copied in as strong a light as possible; this remark applies also to drawings on paper of a yellowish tint. Line drawings should be given a somewhat short exposure, and not be fully developed; opacity can easily be gained by intensification. In copying oil-paintings, it is important that the light should fall in the same direction as that in which it appears to have fallen in the picture, since an artist lays on his colour in such a way that the best effect is obtained when thus lighted. Orthochromatic plates should be used for all pictures in colour, unless a monochromatic light be employed.

When a considerable number of enlargements are required from one negative, it will frequently be found advisable to produce an enlarged negative and then print by contact.

CHAPTER XIX.

ENAMELLING, MOUNTING, AND SPOTTING.

THERE are several methods of producing a brilliantly enamelled surface on prints. The best are those in which the surface is obtained by means of plate-glass or ferrotype plate, in contradistinction to polishing by means of wax or other medium, and friction.

When gelatino-chloride paper is used, it is simply necessary to squeegee the print face down on to a clean ferrotype or glass plate and allow it to dry; when dry it will be found to have acquired a surface resembling that in contact with which it has been dried.

There are a few precautions necessary to the success of this operation; firstly the glass or ferrotype plate must be absolutely clean. Glass plates may be cleaned by washing with soap and water, then with clean water. They should be rubbed quite dry with a clean linen cloth, and then polished with tripoli powder and methylated spirit, applied with a circular motion by the aid of a piece of chamois leather, from which the grease has been removed by strong soda and water. When the glass is thoroughly clean, it should be rubbed over with a solution of spermaceti wax in benzole, ether, or chloroform, all excess of the wax being polished off with an old silk handkerchief. Instead of the solution of wax, French chalk may be sprinkled over the plate, and the excess polished off with a piece of silk. The object of

the wax or French chalk is to avoid any possibility of the print sticking.

If a matt surface be required, the same operations may be carried out, but a ground-glass plate substituted for the ferrotype or polished glass plate.

When prints on albumenized or collodio-chloride paper have to be enamelled, the glass plate prepared as above is coated with collodion, and when this is well set, is washed till greasiness disappears, then flowed over with a hot solution of gelatine. This last coat is allowed to set, and the wet print is squeegeed down on to it; when thoroughly dry a knife inserted under the print at one corner will release it.

Although mounting photographs is a most simple operation, it is one which is almost always badly performed by amateurs; we have seen hundreds of good prints spoilt by bad mounting.

Before speaking of the actual process of mounting, we should like to say a few words on the choice of mounts; it is quite a mistake to suppose that the character and colour of a mount are unimportant; of course, a photograph of exceptional beauty cannot easily be altogether spoilt by the mount, but the appearance of an indifferent or fair photograph can be much improved by judicious selection. The first rule to remember is that the photograph itself is the interesting part of the production, and any mount which by its colour, its surface, its shape, or its ornamentation, distracts the eye and draws the attention away from the photograph is absolutely bad.

With prints on albumenized, collodion, platinum or unenamelled gelatine papers, the best method of mounting is to lay them whilst still damp face down on a sheet of glass one on top of another; if there is

any variety in their sizes, let the smallest be on top, starch the back of the top one, lift one corner with the point of a blunt knife, take it now between the finger and thumb, holding as little as possible so as not to remove the starch, put the open left hand under it, and if it is not a large picture, pick up the mount in the right hand and lay it down upon the starched back of the print; by this means we shall avoid touching the print any more than is necessary; if it be handled much we shall find that when it is dry parts will not adhere, turn it over now and slide the print into its exact position. Sponge round the edges with a clean wet sponge, lay between several thicknesses of clean white blotting-paper, and with a roller squeeze any superfluous starch out, again sponge it to remove this, and lay it to dry upon a table face upwards; it is well to cover it with a sheet of clean paper and lay something over it, a light board will do, to prevent it curling up more than can be helped.

If any difficulty is experienced in putting the print down straight, a couple of pencil dots may be made on the mount showing the position of two of the corners.

We have mentioned only the use of starch, because we are very strongly of opinion that at present it is the only satisfactory mountant. A mountant must be capable of causing the adhesion of the print to the mount; it must be clean, so as not to stain the mount when squeezed out at the edges of the print; it must, further, not cause any chemical action in the print such as would lead to fading or discoloration. The only substance with which we are acquainted which fulfils all these requirements is starch which can now be obtained under the name of Glenfield Photo Starch, of much greater adhesiveness than formerly.

When prints have been enamelled, it is impossible to mount them in a damp state as the surface would be spoilt, the dampness caused by the application of the mountant to the back being sufficient to produce this result. To avoid this, we have found that the simplest plan is after squeegeeing on to the glass in the process of enamelling, to give the back a good coat of starch, and lay upon it a piece of waterproof paper of the same size as the print. After the print is stripped from the glass, it may be pasted to the mount with starch, glue, or any of the ready-made mountants without any fear of destroying the enamel.

Another method of giving a polished surface to the print, besides the well-known method of burnishing in the machine, is to polish the surface, after mounting, with white wax dissolved in turpentine and rubbed on by means of a tuft of cotton wool.

If a matt surface is desired on ordinary albumenized or on gelatine paper, it may be obtained by rubbing the print over, after mounting, with a soft rag and a little fine pumice powder.

One would think there should be no great difficulty in spotting a photograph, but many people seem to fail in doing it neatly and cleanly. The first consideration is the colour. All prints on albumenized paper, gelatino-chloride or collodio-chloride may be spotted with a mixture of Indigo, Lake, and Sepia, warmer or colder, according to the tone of the print; this must have a small amount of gum-arabic added in order to repeat the surface of the paper. It was usual some years ago to mix this spotting colour with the white of an egg, which had been allowed to get stale so that it would flow readily, but this is now seldom used.

To spot platinum prints, the colour must be Lamp-

black and neutral-tint mixed; it will not do to use ivory-black, and of course no gum must be added.

To spot carbon (red chalk) mix Venetian-red, a little crimson-lake, and a little antwerp-blue. The colour of red carbon looks purer than it really is, hence the necessity for antwerp-blue, and to this mixture gum must be added and also ox-gall, as the surface of a carbon print is sometimes very greasy.

It may seem ridiculous to say, "now take up enough colour upon the point of a sable brush, and with it touch the white spot on the print so that it is removed;" that is all there is in the matter, but it is curious to note the amount of dense stupidity that is displayed in this process; some spotters take up the colour and put it by the side of the white spot, probably for the sake of contrast; others make a minute dark spot in the centre of the light one, thus producing a ring of white; and so on, through all the varieties of inaccuracy that can be devised by a slovenly mind and carried out by clumsy fingers.

A very little practice will enable you to see exactly what amount of colour to take up with the brush; here is a good opportunity to give a very useful hint. If we examine a new red sable brush, wetted and brought to a fine point on blotting-paper, we shall see that it often ends in one finely-pointed hair which extends a very little beyond the others, light a match and pass the damp pointed brush rapidly through the flame, the extreme point of this one hair will be burnt off, and we shall be able to spot with much more comfort and precision. The spots of colour we put on are really very small washes, and like all water-colour work they should be put on with one touch. A fruitful cause of bad spotting is the fact of sitting in the wrong light.

It is best to sit at a table-easel with the light coming over our left shoulder, the glass of water and the palette on the right hand.

Prints which are to be enamelled must of course be previously spotted, the spots being touched with a little collodion after spotting; or the spotting may sometimes be done with a lead pencil.

If a print be very spotty take out the largest ones first, and remember, a spot is not removed until it becomes invisible; it is no great improvement to substitute a black spot for a white one.

CHAPTER XX.

FINISHING AND COLOURING PRINTS.

Monochrome—Water-Colour.

PHOTOGRAPHS which require working up in monochrome are generally carbon enlargements mounted on smooth paper. They are, of course, infinite in variety; but the most common subject is a portrait enlarged from some small photograph, very often taken from a group, and in many cases the only copy of the photograph which is obtainable.

Frequently the original is old, faded, and generally defective. We will consider such a photograph to be before us, enlarged from a group taken in the open air with a background of foliage, printed in carbon and mounted on smooth card. The first thing to be done is to clean the surface; this may be effected by rubbing it all over with a piece of ink-eraser, great care being taken not to scratch it. The ink-eraser should be used with a circular motion, and the rubbing should not be continued in one line, or the friction will very soon tear up the gelatine.

The next thing to be considered is whether any portion is too dark, such as the background, shadows round the eyes, under the chin, round the mouth, or any part where excessive darkness is likely, bearing in mind

that the more the original is enlarged the harder the result will be, and the greater will be the contrast. This excess of darkness may be reduced with a sharp knife; it is to be remembered that the knife must be kept keen and sharp, because as the edge grows duller so will it become necessary to use greater force, and the danger of actually tearing up the paper will be rapidly increased. To soften the marks made by the knife the parts which have been scraped may be rubber with ink-eraser, all bad edges being softened in the same manner.

When this is done it will probably be found that the light parts are too light. In order to prepare the surface to take colour, the print must be washed with a large brush charged with cold water, with a very little ox-gall, and allowed to dry. This will in some degree restore the surface of those parts which have been scraped, and will ensure the taking of the colour freely all over.

The colour required will most likely be either a warm brown or a warm purple. A combination of Indigo, Crimson-lake, and Sepia will give nearly any shade likely to be required, adding indigo if wanted cool, but more of the other pigments if warm: mix with it a little—a very little—gum-arabic; if too much gum be used each touch of the brush will show. With a brush charged with this colour, and with broad clean touches, the lost half tones may be restored, and the lights reduced wherever they appear excessive. Work in broad touches, as time and work will thus be saved, while a more powerful effect will be produced.

Any white spots about the picture must be removed with a smaller brush, any minute black spots being taken out with the point of a knife. A good beginning will now have been made, the print being neither too

black nor too white. The whole of the general masses of light and shade will be there, all that remains is to stipple and hatch to a proper degree of finish. Commence with the background, and finish it first, since if the face is finished first the strengthening of the background will probably reduce the effect of the work on the face to such an extent as to spoil it. The hair must then be worked boldly and firmly, the brush being used in as broad a manner as possible, leaving the lights clean and sharp. The next thing to be taken in hand is the clothing, and, lastly, the face so that when that part is finished there will be nothing left to be done which might weaken the effect of the delicate work which will have been put there.

The direction of the lines in working on the face should be the same as those used in retouching a negative or working up a porcelain in water-colours. A good idea of our meaning may be got by examining a steel engraving, and noticing the directions in which the artist has used his graver on various portions of the face. The lines must not be decided, but be rather broad, short patches, about three times as long as wide. Finishing a photograph in monochrome is commenced, as in negative retouching, with the largest surfaces, and all patches taken out; when this is done, it must be repeated on a smaller scale, and again still smaller. If any difficulty is experienced in determining which portions should be first proceeded with, retire some distance from the photograph, then approach; the defects which are noticed from the greatest distance will be those to be first removed. When this has been done it will be easy to stipple up the work to the necessary degree of finish; in so doing, the scraping-knife may be used, if necessary, to take out any minute parts

that are too dark. Next the eyebrows and the pupil of the eye have to be darkened. The lights have to be cleaned up with the knife, using it across the forehead, down the nose, and on the cheek-bones, from the ear towards the mouth. Such parts as the shadow thrown by the head upon the shoulder, if there are any, may be touched carefully with a brush charged with a little very weak gum; this must be used sparingly and with discretion, as a very little too much will vulgarize the whole of the work by giving too great gloss.

If the print be upon porcelain instead of paper the same system must be adopted, with the added consideration that a touch of colour upon porcelain will not have the same value when it is wet as when it is dry, it will either be harder or softer, according to the quality of the porcelain used; experience alone can teach which of these results will happen.

COLOUR.

Before attempting to colour a photograph, it would be well to pay some attention to a few of the elementary laws of colour.

The analysis of colour by means of the prism breaks white light up into seven principal colours, but it should be remembered that these are pure colours, and that it is impossible to obtain pure colours in pigments, just as it is impossible to obtain pure white paper. It is usually considered that there are but three primary pigmentary colours, namely, red, blue, and yellow. Each one of these is complementary to a combination of the other two; thus red is complementary to green, which is a combination of blue and yellow; green, reciprocally, is complementary to red; blue is comple-

mentary to orange, which is a combination of red and yellow; yellow is complementary to purple, which is a combination of red and blue.

If a very strong contrast of colours is wanted, one colour should be opposed to its complementary. For instance, nothing could be more violent than a bright green hat with a red feather. The effect of the green will be to cause the red to appear redder. This is one of the interesting phenomena belonging to what is known as "irradiation"; it is a property of the human eye.

In order to test the truth of this statement, get a clean sheet of white paper and draw three small circles about the size of a halfpenny, about eight inches apart; paint these with a delicate pure grey—Payne's, for example—such as the engineer uses for colouring cast-iron parts in machinery drawings. Surround one of these with a broad belt of red, another with a belt of blue, the third with a belt of yellow. Let the belts be about two inches in width. It will then be seen that the grey circle within the red belt appears green, the circle within the blue belt appears orange, and that within the yellow belt appears purple. Thus the intensity of any colour may be neutralized or increased by the nature of the colour to which it is in proximity.

In colouring the portrait of a gentleman with a very yellow face, such as is acquired by a long residence in tropical climates, it would not be wise to paint the background purple, because this would cause the face to appear very yellow indeed. To weaken the colour of the face, the background should be painted a yellowish brown; there being then very little contrast, the face would not appear unduly yellow. A gentleman with a fresh, reddish complexion may wear a brown

hat, because the contrast is less marked than if he wore a black one.

It is well known that a very sallow, yellowish face should not be thrown into relief by a deep blue neck-tie immediately below it, unless it is specially desired to emphasize the yellowness of the face.

It would be absurd to attempt to lay down arbitrary rules for the colouring of any picture, as there are so many keys in which the subject, whatever it may be, can be treated legitimately, but certain combinations may be borne in mind which have proved effective; these combinations can be repeated as nearly as possible —remembering always that there should be a distinct purpose in whatever is done, not slavish and blind following of a rule laid down by some great artist.

Sir Joshua Reynolds used to insist that the principal figure in a simple composition should be warm in colour, the background and accessories cool. Gainsborough, on the other hand, it is said, painted his celebrated picture "The Blue Boy" to refute this; in this picture the single figure in the foreground is dressed almost entirely in a cool blue, while the background is a warm brown.

A photograph to be coloured presents one very great difficulty to those unpractised in the use of colour. It is already a picture in monochrome; its prevailing colour may be, and often is, a warm purple, as in the case of the ordinary silver print. Whatever colours are mixed, when they are laid on they will have the original colour of the photograph added to them. It will be necessary in some parts to destroy this colour, especially on the face; yet it is evident that the more of the original modelling of the face left, the more likely will be the preservation of the likeness; so that in

mixing the pigments the colour which is already there must be taken into consideration.

The most important consideration is to do away with the black tones, as it should be remembered that there is no black visible in nature, black is simply the absence of light. Poets have talked about "darkness visible," a figure of speech more beautiful and impressive than accurate. Darkness means invisibility; the visible only is of concern at present, any combination therefore that tends to produce blackness should be eliminated from our scheme of colours.

The work of Sir Frederick Leighton is distinguished for its purity and brilliancy of colour. Those, therefore, who have the opportunity, would do well to make notes of the arrangements of colour which he adopts and endeavour to repeat them as well as possible. Watteau also used very pure and delicate arrangements, and is a very good model for the photographic colourist to follow.

COLOURING IN WATER-COLOURS.

As one artist will work on the same subject in a different key from another, so he will also use a different set of colours. One will use indian yellow in mixing the first wash on a face because it is a transparent colour and leaves the modelling very distinct; another, having more confidence in his own powers of drawing, will use yellow ochre on account of its opacity, which is useful in destroying the black tones of the photograph.

Some colours are very closely allied, such as mars orange and burnt sienna, the former being the purer. Cobalt and permanent blue are also similar; the latter is a transparent colour.

The following colours will be found suitable:—

Chinese White.	Burnt Sienna.
Light Red.	Raw Sienna.
Vermilion.	Indian Yellow.
Rose Madder.	Lemon Yellow.
Vandyke Brown.	Carmine.
Cadmium No. 2.	Ultramarine.
Crimson Lake.	Terra Verte.
Aureolin.	Gamboge.
Cobalt.	Indigo.
Emerald Green.	Yellow Ochre.
Sepia.	Scarlet Lake.
Pink Madder.	Permanent Blue.

Mars Orange.

A table-easel, a small pan of ox-gall, and a slab of porcelain about a foot square for a palette will also be required. Let the porcelain slab lie flat upon a small table at the right-hand side. Let all implements that are likely to be wanted be also placed on the right, so that in reaching anything the hand does not have to pass in front of the work. The operator should be so seated that the light falls on the picture from over the left shoulder. The lowest source of light should be not less than six feet from the floor, and if practicable let this light come from a window facing the north, so that it shall be subject to as little variation as possible.

In colouring ordinary silver prints, the first consideration is to get the colour to run easily and freely on the surface.

A clear, light print, one which would be considered a little under-printed, should be chosen; it should be washed over with a large, soft sable brush and clean cold water, which should cover every part and lie evenly upon the whole surface before any attempt at colouring is made. If the water does not lie evenly

upon all parts, the surface must be again washed, and a small quantity of ox-gall added to the water; two brushfuls of water should be sufficient to well cover a cabinet photograph; care must be taken to use only the requisite quantity, neither more nor less. The surface must be rubbed as little as possible, since the albumen is liable to rub off. As soon as this is dry the colouring may be proceeded with.

If it is intended to add to the background of a vignetted picture a suggestion of foliage, furniture, curtains, tapestry, or other objects, these should be worked in first; the reason being that if the head and figure were coloured and worked up first, it would be found that the addition of the background would weaken what had already been done to the face, and this could not be strengthened without destroying the handling, in fact, washing all off and commencing afresh. The background should, therefore, if it is intended to make much difference to the picture, be first put in at its full strength. This is especially necessary in the case of pictures in which the original background has been masked out, leaving a plain white surface for the colourist, as is frequently the case with porcelains. In commencing a background, the exact position of everything should be decided upon, even to the thickness of a line.

Water-colour drawing should be Mosaic in character; the tints should be mixed with great exactness, and laid on carefully but boldly, so that each wash comes exactly up to the edge of the next.

It was formerly the custom to teach water-colour painting thus: first paint in the shadows purplish, next wash with the general colours, and touch-up afterwards; this was before the full capacity of water-colours was

quite realized. The system now is, every colour to be laid on as nearly as possible at its full strength, and as nearly the correct tint as possible; supplementary touches may be added when necessary.

In colouring a photograph on ivory or porcelain care must be taken that each part is quite dry before it is again touched.

As large a brush as possible must be used, as breadth of handling is thus obtained, and a niggling style, which is very undesirable, avoided; work should never look as if the operator were accustomed to use a pencil, and were not at ease with the brush.

Artists who work with a graver or crayon will make a number of lines more or less close together, to represent a flat mass. A painter in oils will cover the same space with a few strokes of his brush, adapting the size of the brush to the size of the surface to be covered, but in water-colour drawing no trace of the method employed should be discernible.

In colouring the portrait of a child with a fresh complexion, fair hair and blue eyes, the first wash for the face may consist of yellow ochre, with a very little vermilion and pink madder. This is laid on quickly, so that it does not dry in any one part before the whole surface is covered. Before it is quite dry the brush must be washed, dried on a piece of white blotting-paper, and with its point the colour removed from between the eyes and eyebrows, from the eyes, and from just where the forehead joins the hair: it is necessary to do this rapidly and cleanly.

When this wash is dry the lower lip is touched with carmine and vermilion, the vermilion in excess. The red of the upper lip, which is generally in shadow, may be washed with pure vermilion, which owing to its

opacity will obscure much of the darkness of the photograph.

While these are drying the eyes may be touched with Cobalt and a little Emerald-green, both opaque colours; the white of the eye may be left for the present the original colour of the photograph, to be touched a little if necessary when nearly finished.

Let the first wash for the hair be composed of Yellow-ochre, Sepia and a very little Raw-sienna, allow this to dry, and you have the predominant colours of the large surfaces.

At that part of the forehead where it joins the hair, where the first wash was wiped away, there may be put a little Emerald-green and Permanent-blue very thin and delicate; this will be the ground-work of the faint half-tone which is found there in nature. The half-tones on the neck, at the sides of the nostrils, the outside corner of the eye, above the eyebrows, and at the corners of the mouth, may be delicately touched with the same colour. A little yellow must now be added; raw sienna will do, and the shadow under the eye touched. Next the inside corner of the eye, and the inside of the nostrils may be touched with Pink-madder and Venetian-red.

Vermilion, Pink-madder and a very little Venetian-red must be mixed and softly stippled and hatched on the cheek, beginning with smooth short touches, each touch about three times as long as wide, inclining from the cheek-bone to the mouth. These strokes should be visible on examination, but if they can be seen at a first glance the effect will be harsh. In laying on this colour, care must be taken not to bring it too near the nose, but to spread it well away towards the ear. The triangular patch of red on a clown's cheek is a bur-

lesque of the red on the human cheek; the shape adopted is not accidental but is copied from life. The colour on the cheek should not be put on at its full strength in the first strokes; these may be strengthened by a second application slightly crossing the first, but a little more horizontal in their direction. Another reason for gaining strength in this part by a second application is, that it is very easy to add to a warm colour, whilst in such a position it is almost impossible to carry out a reduction.

The dark shadows are next to be touched with a mixture of Light-red, Pink-madder and Yellow-ochre, in the corner below the eyebrow and near the nose, under the chin and the shaded part of the nostrils.

If the photograph was originally too white, the half-tones may be strengthened in their deeper parts by a mixture of a delicate grey or permanent blue; Pink-madder and Vandyke-brown, if it is wished to give the grey a yellowish tinge; a little Emerald-green should be added for the lighter parts.

Although the general complexion may be very fresh and brilliant, yet the predominant mass of colour is not very warm; such a face will have its largest surfaces pale with very little red or yellow in them; the red of the cheeks will be soft and brilliant, but the half-tones, the delicate shadows, the bluish and greenish greys of the face will be very much in excess of those parts which are strong and warm in colour. So, if it is desired to avoid confusion in the work, it would be well to put the warmest colours on last, and sparingly, because, as has been said before, it is easier to add to a warm colour than to reduce it. If a shadow is too red, green can be added to neutralize the red, purple when it is too yellow; but if the part that is too warm is one

of the light parts, the only remedy is to wash it all off and commence afresh.

In finishing the hair, the shadows and deep half-tones must be touched with a warm brown mixed with a little gum-arabic. The gum-arabic produces an effect of transparency and depth in the shadows.

Colouring a face with a fair complexion has been described, because in colouring a photograph the object is always to get colour over a picture which is already a monochrome. If the subject be dark, more yellow is required in the first wash, and a deeper key must be adopted in all the shadows; less vermilion on the cheeks, all the reds being lower in tone. This system of work will be found suitable for all photographs, whether printed in silver, platinum or carbon, upon paper, ivory or porcelain; with the proviso that the harder and more dense the material on which the photograph is printed the less porous will it be, and consequently the greater the care and exactitude necessary.

OILS.

There are very few types of photographs suitable for this method of finishing; in fact, the peculiar nature of oil-colours is such that a photograph when coloured with pigments, when oil is used as the vehicle, loses so much of its own characteristics that it can hardly be considered as a photograph at all, but as a painting with a photographic basis. Sometimes, however, such things are desired; it is necessary, therefore, to know how to proceed.

The only process which is of any value under these circumstances is carbon, and the only type of photo-

graph that can with advantage be coloured with oils, is an enlargement of a portrait, or at any rate a large portrait, whether taken direct or enlarged from a small original.

Let the print be in standard brown, and mounted upon rough canvas, strained on an ordinary stretcher. The first thing is to prepare the surface of the print, so that the oil does not sink unevenly into it and dry with a patchy appearance; to do this, brush over it either starch or a mixture of size with very little whitening added. In doing this, it is necessary to handle the brush in the same manner that we have described in our chapter on finishing in water-colour. Allow to dry before proceeding with the first coat of paint.

Commence with the deep shadows, using colours that are opaque, to neutralize the colour of the photograph; next proceed to the half-tones, and lastly to the lights. In this first painting, it is best to work in a rather cool key, no matter what the subject may be; avoid all hot and foxy tones in the flesh; its deepest shadows may be painted in a warm colour, as nearly the tint they are to be when finished as possible. All deep shadows on drapery must be somewhat cool, as they will ultimately be glazed.

Very great care must be observed in order to maintain the exact shape of the shadows. All half-tones on the flesh must be kept cool in colour, and it is as well to mention that, although a great many portrait painters use black in mixing their greys for flesh, in painting photographs this must be avoided, there is already quite enough neutral sombre colour in the photograph.

The lights on the hair may be touched in a strong *brushy* manner, but the exact shapes must be repeated, as the first painting hides all traces of the original

photograph. The work must now be allowed to dry; three or four days will not be found too much for this. When quite dry, the surface must be sponged with clean cold water, the second painting being then proceeded with.

At this stage the half-tones on the flesh may be strengthened and brought up to their proper colour; the general drawing of the face and other parts may be corrected, as it will most likely be found that the relief has been weakened, and the face made flatter than it should be. Deep, broad shadows on the drapery and hair may be re-painted, the divisions between the masses of hair may be indicated more strongly, all sharp edges must be softened. Small reflected lights, such as are found under the chin, in the neighbourhood of the nostrils, on lace or articles of jewellery if the subject be a lady, must be painted carefully, and the picture be again allowed to dry, which will take another three or four days. It must then be rubbed with a rag dipped in a little boiled oil and turps or megilph, to bring all parts of the picture to the same degree of glossiness, which should, however, not be pronounced, the object being to enable the exact relief of each part to be judged. Shadows on the face may now be glazed to their exact depth and colour. The reds of the cheeks may be brought up by scumbling a little more colour over them; high lights may be cleared up; stray locks of hair may be painted in if desirable, and little crisp touches that give character may be added.

When this is done, the picture may be considered as finished.

We have refrained from giving any particular manner of setting the palette, because no two people employ the same, and without some previous knowledge of painting

in oils, any advice we can reasonably give in a photographic work would be of very little assistance. In order to keep the likeness as accurately as possible, it is essential that a duplicate print be kept at hand for reference.

CHAPTER XXI.

COMBINATION PRINTING.

COMBINATION printing is understood to mean the printing of one photograph by combining portions from two or more negatives. Although the necessary operations are all comparatively simple, they require care, judgment, and patience, for their successful performance.

The most simple and frequent application of the process is to the combination of the sky from one negative with the landscape from another; in fact, so prevalent is this practice, that cloud negatives are always stocked by the photographic dealers.

At the photographic exhibitions prizes are frequently won by landscapes in which the clouds have been printed from a separate negative, often one bought from a dealer.

To whom ought such a prize to belong; to the man who photographed the landscape, or to him who took the clouds? In our opinion, one has as much right to claim it as the other.

The practice of printing-in skies from a negative taken by somebody else, and then passing the whole off as one's own work is just as dishonest as copying the whole, or even stealing a print ready mounted, and then sending it in for competition.

Printing-in clouds from separate negatives leads to many absurdities. We have turned over a whole album

of beautiful prints, every one showing clouds, but with only three or four patterns of sky between them. We have also seen competition photographs by different competitors showing the *same* sky.

Very great discretion must be used in deciding whether a sky should be introduced or not, and if so, what class of sky. The absurdity of introducing a stormy sky to complete a landscape of, say, a quiet stream flowing through a meadow where half-a-dozen sheep are quietly grazing, the whole bathed in warm sunshine, and showing no traces of the existence of wind, is obvious; yet, unfortunately, it is not infrequently seen.

The only rule which we are enabled to give on the subject is a negative:—

Never introduce clouds unless clouds were present when the view was taken.

If it is advisable to introduce clouds, it should be so decided at the time of taking the view; very full notes should be made as to the direction and general character of the lighting, the forms of clouds actually present, as well as the state and direction of the wind.

We believe that when it is feared that the clouds will be lost in a view, the only satisfactory course is to expose a second plate for them, and to let the cloud negative thus obtained be used for this view, and no other. Even when this is done, careful judgment will still be required to print the sky just deep enough to give the effect which was actually present, and not as one often sees the effect of a sky, with a subordinate landscape.

If this plan be followed it will be impossible to fall into an absurdity, such as we had the pleasure of noting the other day: we were shown a print which had

gained the first prize at a recent photographic exhibition; the subject was well chosen and well treated; the composition was good; the sky was not printed too deeply, and the manipulation of the horizon line was perfect; yet the photograph caused an uncanny feeling akin to the creeps; we could trace no evidence whatever that the sky had not been taken at the same time as the view, except that the light fell on the left side of the clouds, which had probably been photographed in summer about two hours before or after noon, whereas in the landscape the light fell on the right, and its inclination showed that if the view was taken at the same period of the year as the clouds, it must have been taken about five o'clock in the afternoon. *Yet this was a prize photo!*

We may now explain the reason of the rule given above: "Never introduce clouds unless clouds were present when the view was taken." When the sky is cloudless the light falls strongly from a given point, the shadows are sharp and strong; when, however, clouds are present, even if they do not obscure the sun, they reflect a large amount of light, and this light falls upon the shadows of the subject, rendering them weaker, as well as confusing their outlines. It will thus be seen that however skilfully clouds are introduced into a view taken under a cloudless sky, they will produce an untrue result; the photograph will have what may be called a lying expression.

Having now pointed out the dangerous possibilities of the process with, we hope, sufficient force to prevent the amateur abusing the power placed in his hands, we will attempt to show how its benefits may be obtained in practice.

When it is desired to introduce clouds into a land-

scape, it is first necessary to examine the negative, and to determine whether the sky is sufficiently opaque as to print white, or nearly so. As a rule this will not be the case, and it will be necessary to paint over the sky with black varnish, or cover it with opaque paper.

As a rule, the simplest and most efficacious manner of blocking out the sky will be to paint it over with black varnish on the back of the negative, and to soften the edge of the varnish by dabbing, before quite dry, with a ball of cotton wool enclosed in washleather.

It must always be remembered that in nature the sky is always whiter near the horizon than towards the zenith: it is, therefore, not advisable that the varnish should produce a perfectly uniform white.

Where the horizon line is approximately straight, much time and trouble may be saved in graduating a sky, either in combination with or without a cloud negative, by the use of a curved piece of zinc so formed as to rest upon the glass side of the negative at the horizon line, whilst being further and further from it as the zenith is approached.

In combining a landscape and a cloud negative, it is quite unimportant which of the two is printed first; the only point of importance, after the advisability of the process has been settled, is to prevent any possibility of bad joining, which would at once call attention to the fact that the sky had been inserted, and that clumsily.

In all combination printing, it is of the first importance that the joins should be absolutely invisible; this can only be secured in two ways, either by letting the edge of one portion come *exactly* to the edge of the adjoining portion, which is always difficult, or by letting the edges overlap and vignetting them. In either case the joins should be carefully considered beforehand, as

positions can often be found where they can be made with comparative ease, either at the junction of a dark with a light portion or in a shadow.

The next case of combination to be considered is the joining up of a number of views to form a panorama. There is nothing more unsightly than to see a panorama formed by mounting several separate prints side by side, and the fact that the whole of the negatives can be printed on one strip of paper without any great difficulty renders the practice still more reprehensible.

A few words regarding the production of panoramic negatives may not be out of place.

When two or more negatives are taken with the intention of forming a panoramic view, they must be taken from the same point of view, the camera being simply turned (preferably on a point vertically below the optical centre of the lens) without the tripod being moved; they must also correspond in character and opacity: this correspondence may be secured by giving identical exposures and developing together in one dish. The negatives must also overlap, that is to say, the same portion of the view must appear at the ends of adjoining negatives; the amount of overlap may vary with the size of the plate, but should never, even with a quarter plate, be less than half an inch.

The first negative of the series being put into the frame, and two small marks made close to the end which adjoins the second negative, the paper is placed in the frame, care being taken that the portion to be left for printing the other negatives is protected from light; the end of the negative is covered to the extent of the overlap with an opaque card more or less separated from it, according to the amount of overlap allowed in taking the negatives; the printing is carried

on in diffused light, and when complete the negative is removed.

The two little marks which were made on the negative will have printed on to the paper; these are cut out. The second negative is put into the frame and the paper adjusted till the vignetted portion corresponds exactly with the overlap of this negative; when this adjustment is made, the position of the bits cut out of the edges of the print may be transferred to the second negative with the pencil point, for future guidance. The printing may now be carried out as before, the card being placed so as to cover the print made from the first negative and the overlap of the second. If there are more than two negatives in the series, a card must also be placed so as to vignette the overlapping portion at the other end of the negative, two guide marks being made at this end, as in the case of the first negative.

The next application of this process is that of printing a landscape or other background into a portrait.

It is well to take the portrait with a white or very light background, as this will save a certain amount of blocking out; if the figure is a full length, the ground on which it stands should be included in the portrait negative. It is, perhaps, absurd to remark that when it is intended to print in a landscape background, the costume of the sitter should be such as will not appear ridiculous when combined with the background. For instance, a lady in evening dress would hardly look at home with a snow-covered landscape; nor would the same lady in a winter walking costume look well in a handsome drawing-room, with a glimpse of a flower-decked garden through one of the windows.

One of the easiest ways of making the combination is first to print the figure, after blocking out the back-

ground, if necessary, in the negative. A rough print should have been taken, very carefully cut out and attached to the background negative, in the exact position which the figure is to occupy. The figure print is then placed in the frame with the background negative, and the latter printed in. Guide marks should be made on the negative, as in the case of the panorama, especially if a large number of prints are likely to be required.

In this operation it is advisable that the stopping out should be done on the back of the negatives wherever a slight amount of vignetting effect is not objectionable, but where the face comes against the backgr ound any stopping out must be done on the film.

The most elaborate cases of combination occur in the production of groups and elaborate pictorial compositions from a large number of negatives. In these cases it is almost essential that an exact sketch should be first made, and the portions of the subject allotted to each plate carefully decided. The figures or other objects are then posed and lighted in accordance with the sketch, and the negatives of accessories and backgrounds prepared with equal care, and with the same considerations in view.

Combination printing can be carried out in a similar manner for the production of a transparency from which a complete negative can be printed; the difficulties are of course greatly increased, on account of the invisibility of the image; so much so, in fact, that this method is not worth the trouble it costs unless a large number of prints are required from the combined negative. In which case a print should be made as described, the guide marks being very plainly put in, as it will otherwise be very difficult to get exact registration in the dull light of the dark room.

APPENDIX A.

Formulæ.

Developing formulæ for Negatives.

Hydrochinone :—

			For use—
Water	20 ounces	A	Mix A and B in equal parts.
Hydrochinone . . .	120 grains		
Sulphite of Soda . .	2 ounces		
Water	20 ounces	B	*Note.* With hydrochinone develops common salt acts as a powerful restrainer.
Carbonate of Potash . .	4 „		
Bromide of Potash . .	30 grains		

Eikonogen :—

Water	20 ounces	A	
Eikonogen . . .	½ „		
Sulphite of Soda . .	1½ „		
			For use—
Water	20 ounces	B	Mix A and B in equal parts.
Potassium Hydrate . .	½ „		

Metol :—

Water	20 ounces	A	
Sulphite of Soda . .	2 „		
Metol	½ „		
			For use—
Water	20 ounces	B	Mix A and B in equal parts.
Carbonate of Soda . .	2 „		
Potassium Bromide . .	20 grains		

Amidol :—

Water	20 ounces	A
Sulphite of Soda . .	160 grains	
Amidol	2 ounces	
Water	20 ounces	B
Sulphite of Soda . .	4 „	

For use mix—

Water	60 parts
Solution A . . .	5 „
„ B. . . .	25 „
Potassium Bromide (10%).	1 part

Glycin:—

Water	20 ounce	A
Carbonate of Potash.	130 grains	A
Sulphite of Soda . .	2⅜ ounces	A
Glycin	½ „	A
Water	20 ounces	B
Carbonate of Potash.	4 „	B

For use— Mix A and B in equal parts.

Para-amidophenol: (Rodinal) :—

Water	20 ounces
Sulphite of Soda . .	700 grains
Carbonate of Soda . .	350 „
Para-amidophenol chlorohydrate . . .	70 „

Hydrochinone-Metol:—

Water	20 ounces	A
Sulphite of Soda . .	300 grains	A
Metol	100 „	A
Water	20 ounces	B
Citric acid . . .	25 grains	B
Hydrochinone . . .	100 „	B
Water	20 ounces	C
Carbonate of Potash.	2 „	C

For use mix—

A	1 part
B	1 part
C	1 part
Water	1 part

The proportions of A and B may be varied. A tends to rapid development, with plenty of detail. B to slower development with great density.

Development of Bromide Paper.

Amidol has been found to work extremely well for most brands of paper. The formula given above for negatives

may be employed, and will give prints of a very "black and white" character; but if grey tones are desired they may be obtained by diluting the developer. Eikonogen may also be employed in a very dilute state.

After development with either of these agents the clearing bath is unnecessary, but a few minutes' insertion in an alum bath is desirable.

Faded Negatives.

Negatives which have faded after mercurial intensification may often be restored by soaking in water, and then in:—

Water	20 ounces
Schlippe's Salt	200 grains

Fogged Plates.

Plates which have been fogged by the action of light may be recovered by soaking for five or six minutes in:—

Water	20 ounces
Potassium Dichromate	2 „
Potassium Bromide	½ „
Sulphuric Acid	4 drops

To prevent Halation.

Coat the back of the plate by means of a tuft of cotton wool with:—

Caramel	1 ounce
Burnt sienna	2 ounces
Office gum	1 ounce

Grind together in a mortar, and add two ounces methylated spirit.

Temporary Varnish.

Ether (methylated)	10 ounces
Alcohol („)	10 „
Pyroxyline	¼ „

This collodion is also suitable for enamelling prints.

Toning Formulæ.

Chloride of Gold	2½ grains
Bicarbonate of Soda	10 „
Water	20 ounces

Must be used fresh.

Warm water	20 ounces
Acetate of Lime	20 grains
Chloride of Lime	1 „
Chloride of Gold	10 „

Improves by keeping. Dilute for use with four times its bulk of water.

Hard Water	20 ounces
Bicarbonate of Potash	20 grains
Gold Chloride	2 „

Must be used fresh.

Sodium Phosphate	200 grains
Gold Chloride	2 „
Water	20 ounces

Acetate of Lead	½ ounce
Hyposulphite of Soda	4 „
Water	20 „

Chloride of Gold	2 grains
Acetate of Soda	4 „
Common Salt	4 „
Nitrate of Uranium	2 „
Water	20 ounces

Mounting Medium.

Gelatine	2 ounces
Glycerine	½ „
Methylated Alcohol	2 „
Water	8 „

This mountant does not cockle the prints.

APPENDIX B.

THE following table is given as a guide to the amateur in his earlier experiments, and to show the variations of exposure necessary at various periods of the year and at different hours of the day.

Time of Year.	Time A.M.	LATITUDE. 52°30′ Aperture. f/5·65	f/8	f/16	47°30′ Aperture. f/5·65	f/8	f/16	40°0′ Aperture. f/5·65	f/8	f/16	Time P.M.
About middle of—	4	—	—	—	—	—	—	—	—	—	8
	5	—	—	—	—	—	—	—	—	—	7
	6	—	—	—	—	—	—	—	—	—	6
Jan.	7	—	—	—	—	—	—	·9	1·8	7·2	5
	8	·72	1·41	5·8	·38	·75	3·0	·14	·29	1·16	4
	9	·17	·35	1·40	·11	·22	·88	·07	·14	·56	3
	10	·10	·20	·80	·07	·14	·56	·05	·10	·40	2
	12	·08	·16	·64	·06	·11	·44	·04	·07	·30	12
	4	—	—	—	—	—	—	—	—	—	8
	5	—	—	—	—	—	—	—	—	—	7
	6	—	—	—	—	—	—	—	—	—	6
Feb.	7	·71	1·43	5·72	·6	1·2	4·8	·40	·75	3·0	5
	8	·17	·34	1·36	·12	·23	·93	·08	·16	·64	4
	9	·08	·17	·68	·07	·13	·52	·05	·10	·40	3
	10	·06	·12	·48	·05	·09	·36	·04	·08	·32	2
	12	·05	·10	·40	·04	·08	·32	·04	·07	·28	12
	4	—	—	—	—	—	—	—	—	—	8
	5	—	—	—	—	—	—	—	—	—	7
	6	·95	1·90	7·60	—	—	—	·9	1·8	7·6	6
March	7	·17	·35	1·40	·13	·26	1·01	·13	·26	1·04	5
	8	·12	·24	·96	·09	·12	·48	·06	·11	·44	4
	9	·08	·16	·64	·04	·08	·32	·04	·08	·32	3
	10	·06	·12	·48	·04	·07	·28	·03	·06	·24	2
	12	·01	·08	·32	·03	·06	·24	·03	·05	·20	12
	4	—	—	—	—	—	—	—	—	—	8
	5	·90	1·80	7·20	—	—	—	—	—	—	7
	6	·16	·33	1·32	·15	·3	1·2	·22	·44	1·76	6
April	7	·07	·15	·60	·06	·13	·52	·07	·14	·56	5
	8	·05	·10	·40	·04	·08	·32	·04	·08	·34	4
	9	·04	·08	·31	·03	·06	·24	·03	·06	·26	3
	10	·03	·06	·26	·03	·05	·21	·03	·05	·22	2
	12	·03	·06	·24	02	·05	·19	·02	·05	·20	12
	4	·95	1·9	7·6	—	—	—	—	—	—	8
	5	·20	·40	1·6	·25	·5	2·0	·7	1·3	5·2	7
	6	·08	·16	·64	·08	·16	·64	·11	·22	·88	6
May	7	·05	·10	·42	·05	·09	·38	·06	·11	·44	5
	8	·04	·08	·31	·04	·07	·27	·04	·07	·29	4
	9	·03	·06	·26	·03	·05	·22	·03	·06	·23	3
	10	·03	·06	·22	·02	·05	·18	·02	·05	·20	2
	12	·03	·05	·21	·02	·04	·17	·02	·04	·18	12
	4	·50	1·00	4·00	·7	1·4	5·6	—	—	—	8
	5	·13	·26	1·04	·14	·29	1·16	·43	·86	3·44	7
	6	·07	·14	·56	·06	·12	·49	·09	·18	·72	6
June	7	·04	·09	·38	·04	·08	·32	·05	·10	·40	5
	8	·04	·07	·29	·03	·06	·24	·04	·07	·28	4
	9	·03	·06	·24	·03	·05	·20	·03	·06	·22	3
	10	·03	·05	·22	·02	·04	·18	·02	·05	·19	2
	12	·02	·05	·20	·02	·04	·16	·02	·04	·17	12

Time of Year.	Time A.M.	LATITUDE. 52°.30′ Aperture. f/5·65	f/8	f/16	47°.30′ Aperture. f/5·65	f/8	f/16	40°.0′ Aperture. f/5·65	f/8	f/16	Time P.M.
About middle of— July	4	·42	·95	3·80	·95	1·9	7·6	—	—	—	8
	5	·15	·30	1·20	·18	·36	1·44	·55	1·1	4·4	7
	6	·07	·15	·60	·07	·14	·56	·09	·19	·76	6
	7	·05	·10	·40	·04	·09	·34	·05	·10	·40	5
	8	·04	·07	·30	·03	·06	·25	·01	·07	28	4
	9	·03	·06	·24	·03	·05	·21	·03	·06	·22	3
	10	·03	·05	·20	·02	·04	·18	·02	·05	19	2
	12	·02	·05	·20	·02	·04	·17	·02	·04	·15	12
Aug.	4	—	—	—	—	—	—	—	—	—	8
	5	·42	·95	3·80	·60	1·2	4·8	1·1	2·2	8·8	7
	6	·10	·20	·80	·13	·23	·92	·14	·28	1·12	6
	7	·06	·12	·50	·06	·11	44	·06	·12	·48	5
	8	·04	·09	·35	·04	·08	·30	·04	·08	·31	4
	9	·03	·07	·28	·03	·06	·24	·03	·06	·24	3
	10	·03	·05	·22	02	·05	·20	·03	·05	·20	2
	12	.02	·04	·18	·02	·04	·18	·02	·05	·18	12
Sept.	4	—	—	—	—	—	—	—	—	—	8
	5	—	—	—	—	—	—	—	—	—	7
	6	·35	·68	2·72	·40	·80	3·2	·55	1·1	4 4	6
	7	·10	·20	·80	·09	·19	·76	·09	·18	·72	5
	8	·06	·12	·48	·05	·10	·40	·05	·10	·40	4
	9	·04	09	·35	·04	·07	·30	·04	·07	·28	3
	10	·03	·07	·28	·03	·06	·24	·03	·06	·23	2
	12	·03	·06	·26	·02	·05	·21	·02	·05	·20	12
Oct.	4	—	—	—	—	—	—	—	—	—	8
	5	—	—	—	—	—	—	—	—	—	7
	6	—	—	—	—	—	—	—	—	—	6
	7	·42	·84	3·36	·40	·75	3·0	·23	·45	1·8	5
	8	·11	·23	·92	·09	·18	·72	·07	·14	·56	4
	9	·07	·14	·56	·06	·11	·44	·05	·09	·38	3
	10	·05	·10	·40	·04	·08	·32	·04	·07	·28	2
	12	·04	·09	·36	·03	07	·28	·03	·06	·25	12
Nov.	4	—	—	—	—	—	—	—	—	—	8
	5	—	—	—	—	—	—	—	—	—	7
	6	—	—	—	—	—	—	—	—	—	6
	7	—	—	—	—	—	—	·75	1·5	6·0	5
	8	·52	1 04	4 16	·26	·53	2 1	·12	·24	·96	4
	9	·14	·28	1·12	·09	·19	·76	·06	·13	·52	3
	10	·08	·17	·68	·06	·12	·50	·05	·09	·38	2
	12	·07	·14	·56	·05	·10	·40	·03	·06	.24	12
Dec.	4	—	—	—	—	—	—	—	—	—	8
	5	—	—	—	—	—	—	—	—	—	7
	6	—	—	—	—	—	—	—	—	—	6
	7	—	—	—	—	—	—	—	—	—	5
	8	·58	1·17	6 7	·60	1·2	4·8	·20	·4	1·6	4
	9	·25	·50	2·00	·14	·28	1·12	·08	·16	·64	3
	10	·12	·25	1·00	·08	·17	·68	·06	·12	·48	2
	12	·09	·18	·72	·06	·12	·50	·05	·09	·38	12

The assumptions used for the purposes of this table are a *mean* light—that is to say, enough sunshine to throw a plainly visible but not a strong shadow;—a landscape subject without heavy foliage, but with foreground, and a plate of ordinary (40 H. & D.) rapidity, and a lens of the

rapid rectilinear type, i.e. having two achromatic combinations.

As has already been shown, the exposure required with any given diaphragm is inversely proportional to the area of its aperture or inversely to the square of its diameter; thus—

$$\text{Exposure} \propto \frac{1}{d^2}$$

Where d = diameter of diaphragm opening. Thus under similar circumstances the exposure with $f/16$ will be four times that with $f/8$.

The developer is also an important factor in determining exposure. The above table is calculated for ferrous-oxalate, but if pyrogallic acid and ammonia is to be used, about half these exposures only need be given.

Multiply above exposures by—

For Clouds	0·125
„ Sea and distant landscape . .	0·25
„ Dark buildings or heavy foreground	2 to 4
„ Portraits out of doors . . .	8
„ „ in sitting-room . . .	150
„ Copying line drawings . . .	0·25
„ „ same size as original . .	6
„ Interiors	50 to 500
For slow landscape plate	2
„ Ordinary	1
„ Rapid	·5
„ Extra rapid	·4

In clear, bright sunshine give half, and in dull light twice above exposures.

APPENDIX C.

It is often useful to know the angle of view which a given objective will include on the plate; we have therefore calculated the following table.

The angles given are those included on the length of the plate. No allowance has been made for the overlap of the rebates of the dark slide.

Size of Plate, inches.	4¼ × 3¼	5 × 4	6½ × 4¾	7½ × 5	8 × 5	8½ × 6½	9 × 7	10 × 8	12 × 10	15 × 12
Focus of lens, inches.										
3	70°38′	79°38′	94°36′	102°42′	106°16′	109°34′	°— ′	°— ′	°— ′	°— ′
4	55 58	64 2	78 12	86 18	90 0	93 28	96 44	102 42	—	—
5	46 4	53 8	66 4	73 44	77 20	80 44	84 0	90 0	100 24	—
6	39 0	45 14	56 54	64 1	67 20	70 38	73 44	79 36	90 0	102 42
7	33 46	39 19	49 48	55 28	59 30	62 32	65 30	71 4	81 12	93 58
8	29 45	34 42	44 14	50 14	53 8	55 58	58 43	64 2	73 44	86 22
9	26 36	31 2	39 41	45 15	47 56	50 33	53 8	58 5	67 20	79 36
10	24 0	28 5	36 1	41 8	43 38	46 3	48 28	53 8	61 56	73 44
12	20 5	23 32	30 19	34 42	36 52	39 1	41 8	45 14	53 8	64 1
14	17 16	20 16	26 9	29 58	31 54	33 47	35 39	39 21	46 23	56 22
16	15 8	16 39	22 58	26 23	28 9	29 45	31 24	34 44	41 6	50 16
18	13 28	15 49	20 28	23 32	25 4	26 32	28 5	30 58	36 56	45 14
20	12 8	14 15	18 28	21 15	22 38	23 59	25 22	28 6	33 24	41 6
22	11 32	12 58	16 49	19 21	20 36	21 52	23 7	25 36	30 31	37 30
24	10 7	11 53	15 25	17 46	18 55	20 4	21 35	23 32	28 5	34 44,

The above table is calculated from the formula :—

$$\text{Tangent of } \tfrac{1}{2} \text{ angle of view} = \frac{\text{length of plate}}{\text{focus of lens} \times 2.}$$

APPENDIX D.

Depth of Focus.

So much has been written, and so many formulæ and tables published on this subject with which we differ, that we have deemed it advisable to give the mathematical reasoning on which we base our formulæ.

For the purpose of this investigation we shall make use of diagram 1, page 21, but shall consider the diaphragm to be placed at right angles to the axis and to pass through X, whilst cutting the axis of the lens at D.

Taking the disc of allowable confusion as $\frac{1}{100}''$, we have—

$$a\beta = ac = \tfrac{1}{100}$$

Let diaphragm aperture in inches $= a$
„ focal length of lens in feet $= f$
„ distance of object focussed in terms of $f = n$ $\therefore nf = V$
„ $D\beta = v$; $D\gamma = v'$; $Da = v''$
$DB = V$; $DC = V'$; $DA = V''$

$$\text{from } \frac{1}{v} - \frac{1}{V} = \frac{1}{f}$$

where V is — quantity

$$\therefore \frac{1}{v} + \frac{1}{V} = \frac{1}{f}$$

We have $V = \frac{Vf}{V-f}$; $v' = \frac{V'f}{V'-f}$; $v'' = \frac{V}{V-}$

In diagram 1— (*Geometry.*)

$$100a = \frac{v'}{v - v'}$$

$$= \frac{v'}{\frac{Vf}{V-f}} - v'$$

$$= \frac{v'}{\frac{nf}{n-1}} - v'$$

$$= \frac{v'(n-1)}{nf - v'(n-1)}$$

$$v' \left\{ 100a(n-1) + (n-1) \right\} = 100anf$$

$$v' = \frac{100\ anf}{(n-1)(100a+1)}$$

$$= \frac{n}{n-1} \cdot \frac{100\ af}{100a+1}$$

but $v' = \frac{V'f}{V'-f}$

$$\therefore \quad \frac{V'f}{V'-f} = \frac{n}{n-1} \quad \frac{100af}{100a+1}$$

$$V' \left\{ (n-1)(100a+1) - 100an \right\} = -100anf$$

$$\therefore\ V' = \frac{100\ anf}{100a - (n-1)} \qquad \text{(i.)}$$

In determining V'' we have—

$$100a = \frac{v''}{v'' - v}$$

which by similar substitutions gives—

$$v'' = \frac{n}{n-1} \cdot \frac{100af}{100a-1}$$

$$\frac{l''f}{l''-f} = \frac{n}{n-1} \cdot \frac{100af}{100a-1}$$

$$\therefore \quad l'' = \frac{100anf}{100a+(n-1)} \qquad \text{(ii.)}$$

From the above equations we find—

$$f = V' \frac{100a-(n-1)}{100a} \quad \text{or} \quad V'' \frac{100a+(n-1)}{100a} \qquad \text{(iii.)}$$

$$n = V' \frac{100a+1}{100af+V'} \quad \text{or} \quad V'' \frac{100a-1}{100af-V''} \qquad \text{(iv.)}$$

$$a = V' \frac{n-1}{100\,(V'-nf)} \quad \text{or} \quad V'' \frac{1-n}{100\,(V''-nf)} \qquad \text{(v.}$$

When the distance is focussed for, or a fixed focus lens is used, i.e. when $V = V'$, we have—

$$\frac{V''f}{V''-f} = \frac{100af}{100a-1}$$

$$\therefore \quad V'' = 100af \qquad \text{(vi.)}$$

It must not be neglected, that in the above investigation an error has been introduced with regard to the position of the diaphragm, and in considering the diameter of the cone of rays at the optical centre of the lens as equal to the diaphragm opening.

The insertion of these corrections causes very considerable complication, and as the results given by the above formulæ are sufficiently accurate for all practical purposes, their insertion is unnecessary.

We give the following table calculated from equations (i.) and (ii.) :—

DEPTH OF FOCUS

Focal length of objective in inches.	Aperture.																		Distance of object focussed in feet.
	$f/4$		$f/5{\cdot}656$		$f/8$		$f/11{\cdot}3$		$f/16$		$f/22{\cdot}6$		$f/32$		$f/45\ 2$		$f/64$		
	Nearest Point.	Furthest Point.	Nearest Point.	Furthest Point.	Nearest Point.	Furthest Point.	Nearest Point.	Furthest Point.	Nearest Point.	Furthest Point.	Nearest Point.	Furthest Point.	Nearest Point.	Furthest Point.	Nearest Point.	Furthest Point.	Nearest Point.	Furthest Point.	
	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.
3	2·2	2·8	2·1	3·0	2·0	3·9	1·9	3·8	1·7	4·8	1·5	8·1	1·3	6·3	1·1	∞	0·8	∞	2·5
	4·0	6 7	3·7	7·8	3·3	10·1	2·9	18·4	2·5	∞	2·0	∞	1·6	∞	1·3	∞	1·0	∞	5·0
	6·0	18·3	5·8	37·9	4·9	∞	4·0	∞	3·2	∞	2·5	∞	1 9	∞	1·5	∞	1·0	∞	10·0
4	3·1	3·7	3 0	3·8	2·8	4·0	2·7	4·5	2·5	5·2	2·2	6 8	1·9	11·9	1·6	∞	1·4	∞	3·3
	5·6	1·2	5·3	9·1	4·8	10·7	4·3	14·4	3·8	∞	3·2	∞	2·6	∞	2·1	∞	1·6	∞	6·7
	9·6	21·9	8·6	29·7	7·8	60·3	6·3	∞	5·2	∞	4·2	∞	3·2	∞	2·5	∞	1·8	∞	13·3
5	3·9	4·5	3·8	4·6	3·6	4·9	3·5	5·2	3·2	5·8	3·0	7·0	2·6	9·8	2·3	22·4	1·9	∞	4·2
	7·2	9·8	6·8	10·6	6·4	12·0	5·8	14·6	5·2	21·3	4·5	59·4	3·8	∞	3·1	∞	2·4	∞	8·3
	12·7	24·2	11·6	29·8	10·3	44·3	8·8	144	7·4	∞	6·0	∞	4·8	∞	3·7	∞	2·8	∞	16·7
6	4·7	5·3	4·6	5·5	4·4	5·4	4·2	6·0	4·0	6 6	3·8	7·6	3·4	9·6	3·0	16·2	2·6	12·6	5·0
	8·9	11·4	8·5	12·2	8·0	13·4	7·4	15 6	6·6	20·1	5·8	36·8	5·0	∞	4·D	∞	3·2	∞	10·0
	15·9	27·0	14·6	31·6	13·8	36·6	11·6	75·8	9·8	∞	8·0	∞	6·4	∞	5·0	∞	3 8	∞	20·0
7	5·5	6·1	5·4	6·3	5·2	6·5	5·1	6·8	4·8	7·3	4·5	8·6	4·1	9·9	3·7	13·9	3·2	32·9	5·8
	10·5	13·1	10·1	13·8	9·6	14·9	8·9	16·8	8·1	20·6	7·2	30·2	6·5	93·1	5·2	∞	4·3	∞	11 7
	19·1	30·0	17·7	34·1	16·1	42·1	14·3	63·1	12·3	214·9	10·3	∞	8·4	∞	6 6	∞	5·1	∞	23·3
	32·2	85·1	28·5	128·9	24·5	480·4	20·5	∞	16·6	∞	13·1	∞	10·1	∞	7·6	∞	5·7	∞	46·7
8	6·4	7·0	6·3	7·1	6·2	7·4	6·0	7·6	5·6	8·0	5·4	9·0	5·0	10·4	4·4	13·6	3·8	23·8	6·7
	12·2	14·1	11·8	15·4	11·2	16·4	10·6	18·2	9·6	21·4	8·6	28·8	7·6	∞	6·4	∞	5·2	∞	13·3
	22·3	33·1	20 9	36·8	19·2	43·8	17·2	59·4	15·6	120·6	12·6	∞	10·4	∞	8·4	∞	6·4	∞	26·7
	38·2	88·2	34·2	120·9	29·2	24 9	27·0	∞	20·2	∞	17·7	∞	12·6	∞	10·5	∞	7·1	∞	53·3

9	7·2 13·5 25·5 44·4	7·8 16·4 36·3 92·4	7·1 13·0 24·1 40·1	7·9 17·0 39·7 119·2	6·9 12·8 22·2 35·2	8·1 18·0 45·9 201·4	6·7 12·1 20·1 30·1	8·4 19·7 58·6 8678·5	6·4 11·2 17·7 24·9	8·9 22·6 97·8 ∞	6·1 10·1 15·1 20·1	9·8 28·7 154·9 ∞	5·8 8·9 12·5 15·7	11·0 46·2 ∞ ∞	5·2 7·7 10·2 12·1	13·7 340·0 ∞ ∞	4·6 6·4 8·0 9·1	20·8 ∞ ∞ ∞	7·6 15·0 30·0 60·0
10	18·0 15·5 28·8 50·7	8·6 18·0 39·5 97·4	7·9 15·1 27·0 46·1	8·8 18·7 42·8 120·6	7·8 14·4 25·4 40·8	9·0 19·6 48·4 181·2	7·6 13·6 23·2 35·3	9·2 21·2 59·6 629·9	7·2 12·8 20.6 29.4	9·8 24·0 88·6 ∞	7·0 11·6 17·6 23·9	10·4 29·2 288 ∞	6·4 10.4 14·8 18·9	11·6 42·6 ∞ ∞	6.0 9·0 12 0 14·6	14·0 118·8 ∞ ∞	5·2 7·6 9·6 11·0	19·6 ∞ ∞ ∞	8·3 16·7 33·3 66·7
12	9·7 18·8 35·4 63·3 75·2	10·3 21·4 46·0 108·6 149·3	9·6 18·4 33·7 58·3 68·2	10·4 22·0 49·0 127·4 187·4	9·4 17·8 31·8 52·4 60·1	10·6 22·8 54·0 169·0 294·1	9·2 17·0 29·2 45·9 51·7	11·0 24·4 63·2 213·4 1498·3	8·8 16·0 27·6 39·0 43·1	10·8 26·8 73·2 ∞ ∞	8·4 14·8 23·2 32·1 34·9	12·0 31·2 151·6 ∞ ∞	8·0 13·2 19·6 25·8 27·5	13·6 40·2 ∞ ∞ ∞	7·6 11·6 16·0 20·1 21.1	15·2 73·6 ∞ ∞ ∞	6·8 10·0 12 8 15·3 15·9	19·0 ∞ ∞ ∞ ∞	10·0 20·0 40·0 80·0 100·0
14	11·4 22·1 42·0 76·1 90·9	12·0 24·7 52·5 120·5 162 6	11·3 21·7 40·3 70·7 83.3	12·1 25·3 55·4 137·0 194·4	11·0 21·0 38·2 64·4 74·5	12·2 26·2 60·0 170·2 268·5	10·8 20·2 35·4 57·0 64·8	12·6 27.6 68·1 257·8 584·2	10·4 19·2 32·2 49·0 54·7	13·0 29·8 84·2 960·8 ∞	10·2 17·8 28·6 41·0 44·9	13·6 33·6 126·2 ∞ ∞	9·6 16·2 24·6 33.2 34·7	14·6 41·2 429·8 ∞ ∞	9·0 14·4 20·6 26·2 27·8	17·2 60·4 ∞ ∞ ∞	8·2 13·0 16·8 20 2 21·1	19 8 186·1 ∞ ∞ ∞	11·7 23·3 46 7 93·3 116·7
16	13·0 25·5 48·6 89·1 106·9	13·6 28·0 59·1 132·9 177·2	12·6 25 0 46·9 83·3 98·7	13·8 28·6 61·8 147·9 205·0	12·8 24·4 44·6 76·4 89·2	14·0 28·2 66 2 176·4 264·0	12·6 23·6 41·8 68·4 78·4	14·2 30 8 73 6 241·8 414 1	12·4 22·4 38·4 58·4 67·0	14·8 32·8 87·6 49·8 ∞	12·0 21·2 34·4 54·0 55·5	15·2 36·4 118·8 ∞ ∞	11·2 19·2 31·2 40·4 44·7	16·0 42·8 241.2 ∞ ∞	10·8 17·2 25·2 35·4 38 1	18 0 57·6 ∞ ∞ ∞	10·0 15·2 20·8 25·2 26·9	20·8 ∞ ∞ ∞ ∞	13·3 26·7 53·3 106 7 133·3
18	14·8 28 8 55 2 102·8 123·0 142·3	15·4 31·3 65·7 145 6 192·3 244·7	14 6 28·3 53·6 96·1 114·4 131·0	15·4 31·9 68·6 159·6 217·8 287·7	14·4 27·1 51·1 88·8 104·2 117·7	15 6 33 8 72 6 184·9 267·9 382 1	14·2 26·1 48·2 80·2 92 5 103·0	15·9 34·1 79·5 238·5 397·1 714 1	13 9 25·7 44·5 70·5 79 8 87 4	16 3 36·1 91·9 402·9 1249·7 ∞	13·5 24·2 40·3 60·2 66 8 72·1	16·9 39·4 117·2 ∞ ∞ ∞	12·9 22 4 35 4 49·9 54·3 57 8	17·8 45·3 195 6 ∞ ∞ ∞	12·2 20·3 30·3 40 2 43 0 45·1	19·4 57·5 309·9 ∞ ∞ ∞	11·4 17·9 25·1 31·5 33 3 34·4	22·0 92 5 ∞ ∞ ∞ ∞	15 30 60 120 150 180

Distances greater than 10,000 *f. considered as* ∞ .

APPENDIX E.

We referred in Chapter IV. to the Hurter and Driffield method of determining the speed of plates, and to the characteristic curve of a plate. We do not propose to enter at length into the method of determining these curves, nor even into the deductions which may be drawn from them.

The examination of the curves given below will show that the first portion, corresponding to under exposure, ends at a density of 0·66 in the case of plate No. 1, and at 0·62 in that of plate No. 2. The second portion, corresponding to correct exposure, is a straight line, and lies between densities 0·66 and 1·39 for plate No. 1 and between 0·62 and 1·03 for plate No. 2. If this straight line be produced until it cuts the bottom of the diagram the point of intersection gives the inertia of the plate, to which the speed is inversely proportional. The Hurter and Driffield speed number is obtained by dividing thirty-four by the inertia.

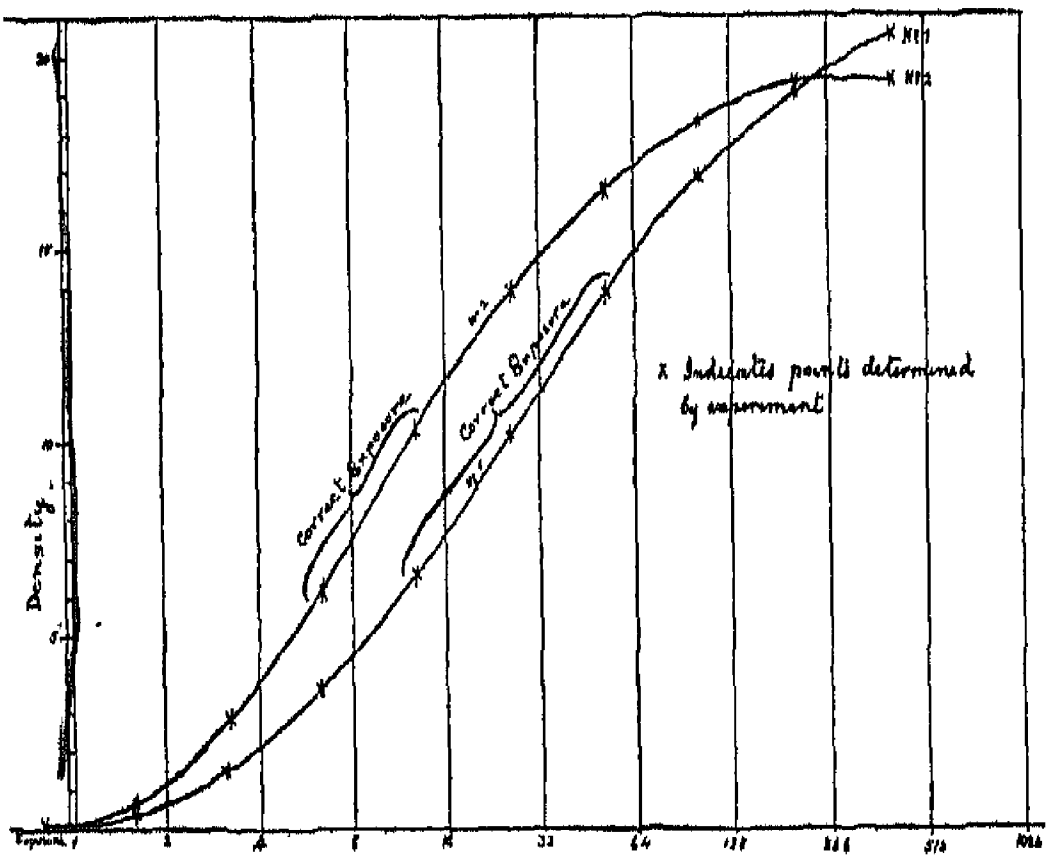


Diagram 1

The first and most important deduction to be drawn from the form of this curve is the capacity of the plate for representing various degrees of light intensity. The longer the straight line forming the central portion of the curve the greater the capacity of the plate.

The following are the particulars referring to the two plates :—

	A	B
Developer	Ferrous oxalate	Ferrous oxalate
Time of Development . .	7 minutes.	10 minutes.
Temperature . . .	65° F.	65° F.
Development factor . .	1·22	1·38
Fog density	0·13	0·10
Inertia	0·58	0·36
Actinograph speed . .	58	94

We stated in Chapter IV. that when the light intensity increased in a geometrical progression, the density—measured by the amount of silver reduced—increased in a corresponding arithmetical progression, and that the resulting opacity increased in a geometrical progression.

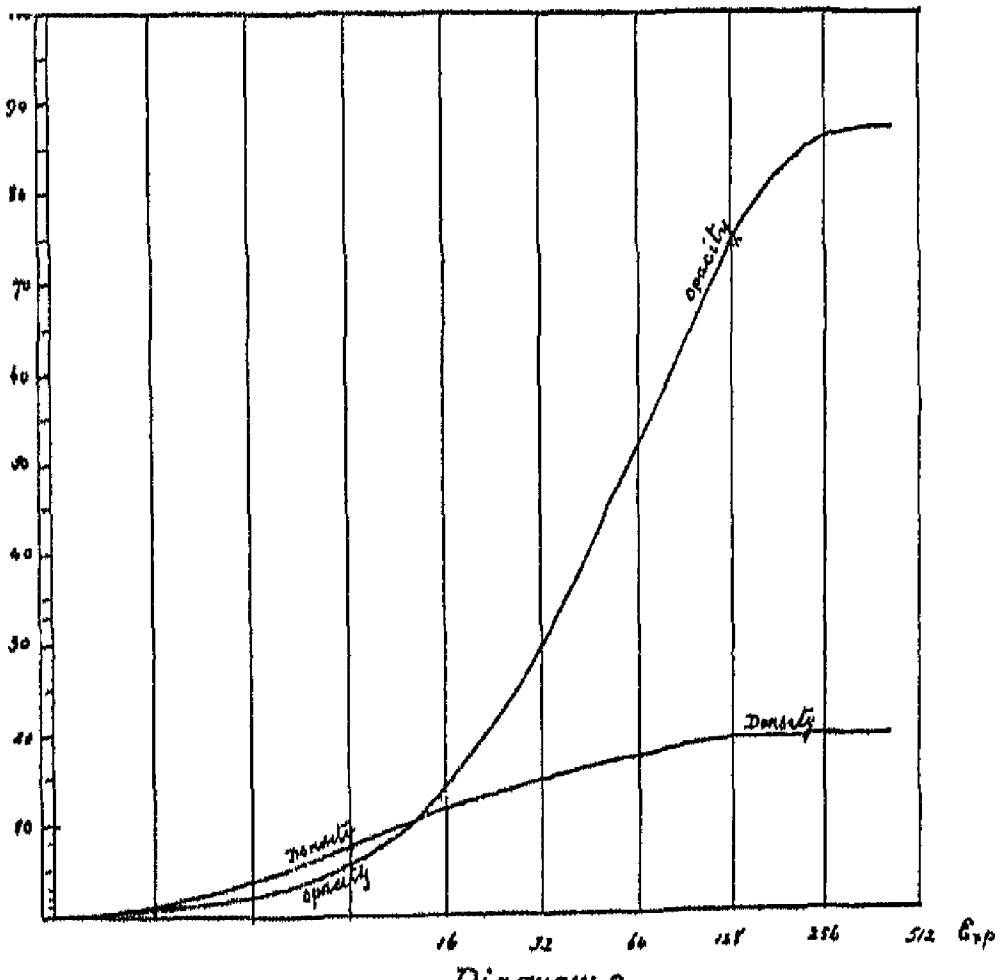


Diagram 2.

It is well known that any term of an arithmetical progression is the logarithm of the same term of the corresponding geometrical progression, so that the curve of opacity can be easily deduced from that of density. Such a curve of opacity is shown in diagram 2.

For complete information on this subject the student should refer to a paper read before the Chemical Society, and to "Photography," February 19th-26th, 1891; to the same journal for July 13th, 1893, and to pamphlets published by Messrs. Marion & Co.

APPENDIX F.

Recovery of Residues.

The waste occurring in the processes we have described may be minimized by precipitating the silver, gold or platinum from the various old solutions, washing waters and baths.

Silver.

It is advisable, whenever possible, to trim prints before toning; as soon as a sufficient quantity of these trimmings, to which have been added the filter papers, through which silver solutions have been passed, and the bits of blotting paper used to catch the drip from the sheets when sensitizing has been collected, they should be burnt, and the ash collected and boiled in nitric acid. The solution of silver nitrate thus obtained may be evaporated, or the silver precipitated from it as chloride by the addition of common salt.

The first washing waters of the prints may be poured into a tub, and the silver precipitated with salt.

Old hyposulphite baths may be preserved, and the ashes left after boiling as above with nitric acid may be added to them, in order to recover the silver chloride which has not been dissolved by the nitric acid. The silver hyposulphite may be precipitated as sulphide by the addition of sulphuretted hydrogen solution or potassium sulphide.

Silver and Gold.

The simplest method is, however, to throw all the residues containing silver into a tub with the old fixing solutions; two or three pieces of sheet zinc are put into this tub, and cause the precipitation of the silver in the metallic state. Every few days the liquid may be poured off to make room for fresh waste. If it is desired to convert this residue into silver nitrate, it should be heated in a crucible to drive off the sulphur, and may then be dissolved in nitric acid. Any gold which may have been introduced by means of trimmings from toned prints or old toning solutions will remain as a grey powder, since it is insoluble in nitric acid. This may be washed and dissolved in a mixture of hydrochloric and nitric acids.

Platinum.

Old developers used in the platinum process may be treated with about a quarter of their bulk of saturated solution of ferrous sulphate, which will cause a precipitate of metallic platinum. The precipitate may be washed and dissolved in a mixture of hydrochloric and nitric acids.

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$27\frac{1}{32}$ grains	= 1 drachm	=	=	1.77185 grammes.
16 drachms	= 1 ounce	= $437\frac{1}{2}$ grains	=	28.35 „
16 ounces	= 1 pound	= 7000 „	=	453.59265 „

Liquid.

60 minims (*drops*)	= 1 drachm	=	=	3.549 cc.
8 drachms	= 1 ounce	= 480 minims	=	28.396 cc.
20 ounces	= 1 pint	= 9600 „	=	567.93 cc.

Conversion from Metric System.

1 gramme	=	15.432 grains.
100 „	=	3 ounces 8 drachms 10.825 grains.
1000 „	=	2 lbs. 3 ounces 4 drachms.
1 cubic centimetre	= 1 gramme (H_2O)	= 17 minims (nearly).
100 „ „	= 1 decilitre	= 3 ounces 4 drachms 10.27 minims.
1000 „ „	= 1 litre	= 1 pint 15 ounces 1 drachm 42.7 minims

1 grain = 0.0647989 grammes.

Apothecaries.

Abolished by law but still frequently used for photographic formulæ.

20 grains	=	1 scruple.
3 scruples	=	1 drachm.
8 drachms	=	1 ounce.

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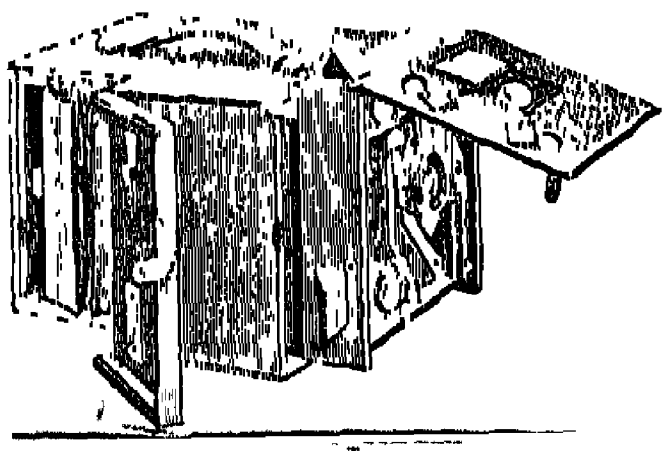

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